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**Index**  
Volumes 55 and 56 (1978)

**Part 2: Subject Index**

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 Shoenfield, J. R. Martin's axiom. (Hungarian) **(56** #2823)  
 Silberger, D. M. See Ehrenfeucht, Andrzej, **55** #10273  
 Solomon, R. C. Families of sets and functions. **56** #15429  
 Solovay, Robert M. See Prikrý, Karel, **(55** #5443)  
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 Williams, N. H. Tightly packed families of sets. **55** #12527

04A25 Axiom of choice and equivalent propositions (Zorn's Lemma, etc.) [See also 02K20.]

- Bokštein, M. F. On the proof of Zermelo's theorem and Zorn's lemma. (Russian) **56** #11803  
 Dawson, John W., Jr. (with Howard, Paul E.) Factorials of infinite cardinals. **(55** #7779)  
 Harper, Judith M. (with Rubin, Jean E.) Variations of Zorn's lemma, principles of cofinality, and Hausdorff's maximal principle. I. Set forms. **56** #5300a  
     (with Rubin, Jean E.) Variations of Zorn's lemma, principles of cofinality, and Hausdorff's maximal principle. II. Class forms. **56** #5300b  
 Howard, Paul E. See Dawson, John W., Jr., **(55** #7779)  
 Palladino, D. L'assioma di scelta. **55** #12528  
 Prikrý, Karel Determinateness and partitions. **(56** #11802)  
 Rubin, Jean E. See Harper, Judith M., **56** #5300a and Harper, Judith M., **56** #5300b  
 Wesley, Eugene Borel preference orders in markets with a continuum of traders. **(55** #11955)

04A30 Continuum hypothesis, generalized continuum hypothesis [See also 02K25.]

- Baumgartner, J. E. (with Prikrý, Karel) Singular cardinals and the generalized continuum hypothesis. **(55** #2575)  
 Csirmaz, László See Shoenfield, J. R., **(56** #2823)  
 Martin, Donald A. Hilbert's first problem: the continuum hypothesis. **55** #7790  
 Prikrý, Karel See Baumgartner, J. E., **(55** #2575)  
 Shoenfield, J. R. Martin's axiom. (Hungarian) **(56** #2823)

04A99 None of the above, but in this section

- Hajnal, Miklos See Kőczy, László T., **56** #8370  
 Kőczy, László T. (with Hajnal, Miklos) A new fuzzy calculus and its application as a pattern recognition technique. **56** #8370  
 Muszyński, Wojciech Properties of fuzzy sets. (Polish. English and Russian summaries) **56** #15430  
 Negoită, Constantin Virgil (with Ralescu, D. A.) ★Mulțimi vagi și aplicațiile lor. (Romanian) [Fuzzy sets and their applications] **(55** #7589)  
 Radecki, Tadeusz Level fuzzy sets. **56** #11804  
 Ralescu, D. A. See Negoită, Constantin Virgil, **(55** #7589)

## 05-XX COMBINATORICS [For finite fields, see 12Cxx.]

05-01 Elementary exposition (collegiate level)

- Fisher, James L. ★Application-oriented algebra. **(56** #15111)  
 Flachsmeier, Jürgen ★Kombinatorika. (Polish) [Combinatorics] **56** #15431  
 (Gawron, Irena) See Flachsmeier, Jürgen, **56** #15431  
 Jeger, Max ★Einführung in die Kombinatorik. Band 1. **56** #15432  
 (Mnich, Werner) See Flachsmeier, Jürgen, **56** #15431  
 Street, Anne Penfold (with Wallis, W. D.) ★Combinatorial theory: an introduction. **56** #2831  
 Wallis, W. D. See Street, Anne Penfold, **56** #2831

05-02 Advanced exposition (research surveys, etc.)

- Behzad, Mehdi (with Chartrand, Gary) ★Introduction to the theory of graphs. **55** #5449  
 Chartrand, Gary See Behzad, Mehdi, **55** #5449

- (Gavrilov, G. P.) See Wilson, Robin J., **56** #5302  
 Hall, Marshall, Jr. Construction of combinatorial designs. (Italian summary) **55** #12529  
 Harary, Frank An exposition of the reconstruction conjecture for graphs. **56** #2832  
 Lenstra, J. K. (with Rinnooy Kan, A. H. G.) Traveling on a graph. (Dutch) **55** #110  
 van Lint, J. H. Recent developments in combinatorics. (Dutch) **56** #5301  
 (Nikitina, I. G.) See Wilson, Robin J., **56** #5302  
 Rinnooy Kan, A. H. G. See Lenstra, J. K., **55** #110  
 Segre, Beniamino Teorie combinatorie. **55** #7791  
 de Villamarin, Gilma Some topics in graph theory. (Spanish) **55** #111  
 Wilson, Robin J. ★Введение в теорию графов. (Russian) [Introduction to graph theory] **56** #5302

05-03 Historical

- Abe, Gakuhō Magic squares that occur in Yang-Hui's mathematics. (Japanese) **55** #112  
 Biggs, Norman L. (with Lloyd, E. Keith; Wilson, Robin J.) ★Graph theory: 1736-1936. **(56** #2771)  
 Lloyd, E. Keith See Biggs, Norman L.; et al., **(56** #2771)  
 Wilson, Robin J. See Biggs, Norman L.; et al., **(56** #2771)  
 (Yang-Hui) See Abe, Gakuhō, **55** #112

05-04 Explicit machine computation and programs (not the theory of computation or programming)

- Dempster, M. A. H. Two algorithms for the time-table problem. **(55** #2634)

05-06 Collections of papers; proceedings of conferences

- (Cameron, P. J.) See Combinatorial surveys, **56** #2833  
 (Little, Charles H. C.) See Combinatorial mathematics, **56** #8372  
 Colloquio:  
     Teorie Combinatorie ★Colloquio Internazionale sulle Teorie Combinatorie. Tomo I. **55** #113  
     ★Colloquio Internazionale sulle Teorie Combinatorie. Tomo II. **56** #8371  
 Combinatorial mathematics ★Combinatorial mathematics. V. **56** #8372  
 Combinatorial surveys ★Combinatorial Conference. **56** #2833  
 Combinatorial theory See Colloquio: Teorie Combinatorie, **55** #113 and Colloquio: Teorie Combinatorie, **56** #8371  
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     Australian, Combinatorial Mathematics See Combinatorial mathematics, **56** #8372  
     British Combinatorial See Combinatorial surveys, **56** #2833  
 Egham See Combinatorial surveys, **56** #2833  
 Melbourne See Combinatorial mathematics, **56** #8372  
 Rome See Colloquio: Teorie Combinatorie, **56** #8371

## 05Axx Classical combinatorial problems

- Erdős, Paul Problems and results in combinatorial analysis. **55** #5450

05A05 Combinatorial choice problems; subsets, representatives

- Abbott, H. L. (with Hanson, D.) On finite  $\Delta$ -systems. II. **56** #8373  
 Anderson, Ian Intersection theorems and a lemma of Kleitman. **55** #10274  
 Baker, Ronald D. (with Wilson, Richard M.) Nearly Kirkman triple systems. **56** #133  
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 Botlik, Oldřich Modifications of object sizes and box capacities to achieve a simultaneous fitting. **56** #15434  
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     Antichains in the lattice of subsets of a finite set. **56** #11806  
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     On families of finite sets no two of which intersect in a singleton. **56** #15437  
     On the minimum number of disjoint pairs in a family of finite sets. **55** #115  
     (with Hilton, A. J. W.) On the minimum number of sets comparable with some members of a set of finite sets. **55** #12530  
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     See also Frankl, Peter, **55** #12530  
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- Belocerovskii, I. M.** See **Belocerovskii, B. M.**, **55** #7797
- Bender, Edward A.** Errata: "Asymptotic methods in enumeration" (SIAM Rev. **16** (1974), 485-515). **55** #10276
- de Biasi, Jean** Applications  $\theta$ -croissantes; généralisation du problème de Terquem. (English summary) **56** #144
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- Das, Shawpaw Kumar** Errata: "On the enumeration of finite maximal connected topologies" (J. Combinatorial Theory Ser. B **15** (1973), 184-199). **55** #7798
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### 06-02 Advanced exposition (research surveys, etc.)

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#### 06A45 Order topologies [See also 54F05.]

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#### 06A70 Ordered rings, algebras, modules [For ordered fields, see 10M15, 12J15.]

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- Feinberg, Robert B. Faithful distributive modules over incidence algebras. (55 #413)
- Felgner, Ulrich Das Problem von Souslin für geordnete algebraische Strukturen. (55 #7785)
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- Mihalev, A. V. Topological and ordered modules. (Russian) (56 #5667)
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#### 06A75 Other ordered algebraic structures

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- Lugowski, Herbert ★Grundzüge der universellen Algebra. **56** #213

#### 08–02 Advanced exposition (research surveys, etc.)

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- Werner, Heinrich Was ist allgemeine Algebra? **56** #15528

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# 08-06 Collections of papers; proceedings of conferences

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# 08A05 Structure of general algebras and relational systems [For topological representations, see 54H10.]

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El'kin, L. N. On the question of simple positional operatives. (Russian) (56 #8741)

Fraissé, Roland Chaines compatibles pour un groupe de permutations. Application aux relations enchainables et monomorphes. 55 #7884

Gillam, D. W. H. Bounds of finite relations. 55 #237

Golema-Hartman, K. Exchange property and  $t$ -independence. 55 #7885

Henno, J. Densely imbedded left ideals of Menger systems. II. (Russian. Estonian and English summaries) 56 #15529

Holman, Eric W. Extensive measurement without an order relation. 56 #11866

Homjakov, M. V. See Borščev, V. B., (55 #5249)

Klipker, I. A. An abstract characteristic of the semiring of binary relations on a finite set. (Russian. Georgian summary) (55 #10355)

Kopeček, Oldřich Construction of all machine homomorphisms. (Russian summary) (55 #4787)

Malita, Mihaela The Čech topology and tolerance relations. (Romanian. English summary) 56 #15530

Movsisjan, Ju. M. Lattice of congruences of algebras of second degree. (Russian. Armenian summary) 56 #215

Mycielski, Jan (with Taylor, Walter) A compactification of the algebra of terms. 55 #7886

Nelson, Evelyn See Banaschewski, Bernhard, 55 #2704

Niemenen, Juhani Filters and simple graphic algebras. 56 #11867

Pašenkov, V. V. On a duality theorem. 55 #12596

Perry, R. J. Completely regular relational algebras. (56 #445)

Piaget, J. Structures et catégories. (56 #5200)

Shay, P. Brian See Aissen, Michael, 56 #11864

Skornjakov, L. A. Complements in the congruence lattice of a polygon over a commutative monoid. 55 #10353

Šul'c, M. M. Relations that are definable by functions of the algebra of logic. (Russian) 56 #2898

Taylor, Walter See Mycielski, Jan, 55 #7886

Teppati, G. On the existence of congruences in general algebras. (Italian summary) 55 #238

Wiegandt, Richard A general radical theory and its application in topology and graph theory. 56 #11868

Zelinka, Bohdan Intersection graphs of set families closed under intersection and satisfying the descending chain condition. 55 #5497

Zelinka, Bohdan Tolerance in algebraic structures. II. 56 #15531

Zimmermann, Karel A general separation theorem in extremal algebras. (Czech summary) 56 #11869

# 08A10 Free algebras, sums, products, limits, colimits

Adams, M. E. (with Kelly, David) Disjointness conditions in free products of lattices. (55 #12585)

Henno, J. Free  $\Omega$ -systems. (Russian. English summary) 56 #15532

Hoogewijs, Albert Free distributively generated algebras over a set. (Dutch summary) (55 #5704)

Kelly, David See Adams, M. E., (55 #12585)

Monro, G. P. The strong amalgamation property for complete Boolean algebras. (55 #2563)

# 08A15 Varieties of algebras and generalizations

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Batbedat, André Préalgebres, biunalgebres et unalgebres. I. (Italian summary) 56 #5390

Belesov, A. U. Equationally compact systems. (Russian) (56 #5275)

Bergman, George M. On the existence of subalgebras of direct products with prescribed  $d$ -fold projections. 56 #11870

Beutler, Eckart An idealtheoretic characterization of varieties of abelian  $\Omega$ -groups. 56 #8466

Blok, Willem J. (with Köhler, Peter) The semigroup of varieties of generalized interior algebras. 56 #15533

Bloom, Stephen L. Varieties of ordered algebras. 55 #239

Bulman-Fleming, S. (with Werner, Helmut) Equational compactness in quasi-primal varieties. 55 #2706

(with Werner, Helmut) Equational compactness in quasi-primal varieties. 55 #2705

Burris, Stanley An example concerning definable principal congruences. 56 #216

Bounded Boolean powers and  $\equiv_n$ . 56 #8467

Choe, Tae Ho Injective and projective zero-dimensional compact universal algebras. 55 #10354

Clark, David M. (with Krauss, Peter H.) Varieties generated by para primal algebras. 55 #2707

Dantoni, Giovanni Sulle algebre le cui operazioni si possono esprimere mediante certe altre operazioni prefissate. (English summary) 55 #240

Davey, Brian A. Weak injectivity and congruence extension in congruence-distributive equational classes. 56 #217

Dixon, P. G. Varieties of Banach algebras. (55 #8794)

Dráskovičová, Hilda Mal'cev type conditions for two varieties. (Russian summary) 56 #15534

Franci, Raffaella ★Filtral and ideal classes of universal algebras. 55 #12597

Genov, G. K. On the theory of operations on the class of all groups. (Russian) 55 #10355

Golema-Hartman, K. Minimal algebras in some class of algebras. 55 #10356

Gorbunov, V. A. Lattices of quasivarieties. (Russian) 56 #5391

Hałkowska, Katarzyna On some operator defined on equational classes of algebras. 55 #5498

Igošin, V. I. Characterizable classes of algebraic systems. (Russian) 55 #12598

Remarks on characterizable classes of algebras with examples from the theory of semigroups. (Russian) 56 #15535

Ježek, Jaroslav Varieties of algebras with equationally definable zeros. (Loose Russian summary) 56 #11872

Jónsson, Bjarni Varieties of algebras and their congruence varieties. 55 #241

Identities in congruence varieties. 55 #12599

Kaiser, H. K. Contributions to the theory of polynomially complete algebras. 55 #10357

Keimel, Klaus (with Werner, Heinrich) Stone Dualität für primitive Klassen, die von quasi-primalen Algebren erzeugt werden. Zusammenfassung. 56 #8468

Kepka, Tomáš Epimorphisms in some groupoid varieties. 55 #12600

Köhler, Peter See Blok, Willem J., 56 #15533

Krauss, Peter H. See Clark, David M., 55 #2707

McNulty, George F. The decision problem for equational bases of algebras. (55 #5428)

Mitschke, Aleit Near unanimity identities and congruence distributivity in equational classes. 56 #11871

Padmanabhan, R. Equational theory of algebras with a majority polynomial. 55 #7887

Polin, S. V. Identities of finite algebras. (Russian) 55 #12601

Popov, A. P. A groupoid of varieties of associative algebras. (Russian) 56 #15536

Rjabuhin, Ju. M. Countably generated locally  $M$  algebras. (Russian) 56 #11873

Romanowska, Anna Some equational classes of distributive  $P$ -algebras. 55 #7888

Sallii, V. N. Lattices of varieties. Lattice relations. Ordered sets. (Russian) 55 #10358

Sangalli, Arturo A. L. Sugli automorfismi delle categorie di algebre simili. (English summary) 55 #10359

Smirnov, D. M. Regularly definable varieties of algebras. (Russian) 55 #12602

Smith, Jonathan D. H. ★Mal'cev varieties. 55 #5499

Szendrei, Agnes The operation ISKP on classes of algebras. 55 #242

Taylor, Walter Varieties of topological algebras. 56 #5392

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# 08A20 Axiomatic model classes

Makkai, Michael Algebraic operations on classes of structures and their connections with logical formulas. II. (Hungarian. English summary) (56 #5278)

Nelson, Evelyn Classes defined by implications. 56 #218

Trahtenbrot, B. A. On universal classes of program schemes. (55 #11682)

Yasuhara, M. The generic structures as a variety. (Russian summary) (56 #5274)

# 08A25 Universal algebra

Abraham, Imrich Minimal sets of generators in unary algebras. (Russian. Loose English summary) 55 #2708

Blum, E. K. (with Estes, D. R.) A generalization of the homomorphism concept. 55 #7889

Bol'bot, A. D. Imbedding of cancellation semigroups in mono-associative  $IP$ -loops. (Russian) (56 #8739)

Burris, Stanley Boolean powers. 56 #5393

Ceitin, D. I. Local theorems for certain algebraic systems. (Russian. Georgian summary) 55 #12603



- Choe, Tae Ho** (with Hong, Y. H.) Extensive subcategories in universal topological algebras. **55** #243
- Dhtjar', M. B.** "Almost onto" homomorphisms of partial  $\mathfrak{P}$ -operatives. (Russian) **55** #10360
- Dixon, P. G.** Classes of algebraic systems defined by universal Horn sentences. (**56** #114)
- Dorninger, D.** Polynomials and polynomial functions on lattices. (**55** #2677)
- Dudek, J.** On non-associative groupoids. **56** #219
- Eigenthaler, G.** Eine Anwendung eines Satzes von Gaschütz auf Polynompermutationen über endlichen Multioperatorgruppen. **56** #5394
- Erdős, Paul** (with Fajtlowicz, Siemion) On composition of polynomials. (**56** #330)
- Estes, D. R.** See **Blum, E. K.**, **55** #7889
- Fajtlowicz, Siemion** See **Erdős, Paul**, (**56** #330)
- Glazek, K.** (with Michalski, J.) Weak homomorphisms of general algebras. **56** #15537
- Golunkov, Ju. V.** On the theory of systems of algorithmic algebras. (Russian) **56** #220
- Hong, Y. H.** See **Choe, Tae Ho**, **55** #243
- Jakubiková, Danica** Homomorphisms of unary algebras. (Russian. Loose English summary) **55** #2709
- Ježek, Jaroslav** (with Kepka, Tomáš) Varieties of Abelian quasigroups. (**56** #8740)
- Kepka, Tomáš** See **Ježek, Jaroslav**, (**56** #8740)
- Kopeček, Oldřich** The category of connected partial unary algebras. (Loose Russian summary) **56** #11874
- Lecomte, Pierre-Claude** Endo-extensions inséparables. (English summary) **55** #5500
- Logan, G. J.** Note on the Frattini-Neumann-Schmidt intersection theorem. **55** #5501
- Michalski, J.** See **Glazek, K.**, **56** #15537
- Mitschke, Aleit** Summen von gerichteten Systemen von Algebren. **56** #2899
- Movsisjan, Ju. M.** Generalized distributivity identities of nonzero rank. (Russian. Armenian summary) **55** #5502
- On the theory of homomorphisms of universal algebras. (Russian. Armenian summary) **55** #5503
- Pasini, Antonio** Affine coordinatization of incidence spaces by universal algebras. (**55** #3950)
- Petrescu, Adrian** On the homotopy of universal algebras. I. **56** #221
- Pierce, Keith R.** Amalgamated sums of abelian  $l$ -groups. (**55** #2702)
- Plonka, Jerzy** Associative and idempotent algebras are at most ternary. **55** #10361
- Prešić, Marica D.** (with Prešić, Slaviša B.) On the embedding of  $\Omega$ -algebras in groupoids. **56** #5395
- Prešić, Slaviša B.** See **Prešić, Marica D.**, **56** #5395
- Pudlák, Pavel** A new proof of the congruence lattice representation theorem. **55** #2710
- Quackenbush, Robert W.** Appendix: Finite simple algebras in congruence permutable varieties. **55** #7890
- Rosenberg, I. G.** The set of maximal closed classes of operations on an infinite set  $A$  has cardinality  $2^{2^{|A|}}$ . **55** #2711
- Sauer, Norbert** (with Stone, M. G.) The algebraic closure of a function. **56** #222
- Skornjakov, L. A.** Generalizations of modules. (Russian) **56** #5396
- Stone, M. G.** See **Sauer, Norbert**, **56** #222
- Taylor, Walter** Varieties obeying homotopy laws. **55** #7891
- Varecza, László** The set of ergodic groups of universal algebras. **56** #223
- Werner, Heinrich** Which partition lattices are congruence lattices? **56** #224
- Žembery, Ivan** Characterization of operations in algebras by means of partially ordered sets. (Russian. Loose English summary) **56** #11875

## 10–XX NUMBER THEORY [Excluding 10Axx and 10Mxx, this classification scheme does not distinguish work in the rational number fields from that in other algebraic number fields.]

### 10–01 Elementary exposition (collegiate level)

- Agnew, Jeanne** ★Explorations in number theory. **56** #2900
- Aigner, Alexander** ★Zahlentheorie. **56** #2901
- Apostol, Tom M.** ★Introduction to analytic number theory. **55** #7892
- Castaldo, P.** Alcuni criteri particolari di divisibilità. **55** #2712
- Chee, P. S.** Fibonacci numbers. (**56** #5409)
- Depman, I. Ja.** Bertrand's hypothesis. (Russian) **56** #11876
- Koch, Helmut** (with Pieper, Herbert) ★Zahlentheorie. **55** #12604
- Pickert, Günter** Größenbereiche, Masszahlen und Dezimaldarstellungen. **56** #5397
- Pieper, Herbert** See **Koch, Helmut**, **55** #12604
- Pignataro, Salvatore** I gruppi delle forme quadratiche binarie canoniche. **55** #2713
- Popovici, Constantin P.** ★Teoria numerelor. (Romanian) [Theory of numbers] **56** #5398
- Rieger, Georg Johann** ★Zahlentheorie. **55** #5504
- Schwarz, Wolfgang** ★Einführung in die Zahlentheorie. **55** #7893
- Tan Keng Teh** Some aspects of prime numbers. **55** #7894

### 10–02 Advanced exposition (research surveys, etc.)

- Berndt, Bruce C.** Modular transformations and generalizations of several formulae of Ramanujan. **55** #2714
- Erdős, Paul** Remarks on some problems in number theory. **55** #2715
- Problems and results on combinatorial number theory. II. **56** #2902
- Gundlach, Karl-Bernhard** ★Einführung in die Zahlentheorie. (**55** #10415)
- Postnikov, A. G.** ★Введение в аналитическую теорию чисел. (Russian) [Introduction to analytic number theory] **55** #7895
- Shorey, T. N.** Some applications of linear forms in logarithms. **56** #8469

### 10–03 Historical

- Berndt, Bruce C.** Classical theorems on quadratic residues. (**56** #229)
- (Fursa, T. G.) See **Bibliography: Linnik, Ju. V.**, (**56** #15336)
- (Ibragimov, I. A.) See **Bibliography: Linnik, Ju. V.**, (**56** #15336)

- Lee, Elvin J.** (with Madachy, Joseph S.) The history and discovery of amicable numbers. I. (**56** #5165a)
- (with Madachy, Joseph S.) The history and discovery of amicable numbers. II. (**56** #5165b)
- (with Madachy, Joseph S.) The history and discovery of amicable numbers. III. (**56** #5165c)
- (with Madachy, Joseph S.) Errata: "The history and discovery of amicable numbers. I" (J. Recreational Math. **5** (1972), no. 2, 77–93). (**56** #5165d)
- (with Madachy, Joseph S.) Errata: "The history and discovery of amicable numbers. I" (J. Recreational Math. **5** (1972), no. 2, 77–93). (**56** #5165e)
- (Linnik, Ju. V.) See **Bibliography: Linnik, Ju. V.**, (**56** #15336)
- Madachy, Joseph S.** See **Lee, Elvin J.**, (**56** #5165a); **Lee, Elvin J.**, (**56** #5165b); **Lee, Elvin J.**, (**56** #5165c); **Lee, Elvin J.**, (**56** #5165d) and **Lee, Elvin J.**, (**56** #5165e)
- Rankin, R. A.** Ramanujan's unpublished work on congruences. **56** #5399
- (Rinnooy Kan, A. H. G.) See **Rankin, R. A.**, **56** #5399
- (Vinogradov, A. I.) See **Bibliography: Linnik, Ju. V.**, (**56** #15336)
- Weil, André** La cyclotomie jadis et naguère. **56** #225
- La cyclotomie jadis et naguère. **55** #5505

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- Linnik, Ju. V.** See **Bibliography: Linnik, Ju. V.**, (**56** #15336)

### 10–04 Explicit machine computation and programs (not the theory of computation or programming)

- Adleman, Leonard** See **Manders, Kenneth**, (**55** #11710)
- Bays, Carter** (with Hudson, Richard H.) The segmented sieve of Eratosthenes and primes in arithmetic progressions to  $10^{12}$ . (**56** #5405)
- (Belaga, E. G.) See **Computations in algebra and number theory**, (**56** #15248)
- Brent, Richard P.** Computation of the regular continued fraction for Euler's constant. (**55** #9490)
- (Faddeev, D. K.) See **Computations in algebra and number theory**, (**56** #15248)
- Gupta, Hansraj** (with Khare, S. P.) On  $\binom{k}{2}$  and the product of the first  $k$  primes. **56** #11877
- Hudson, Richard H.** See **Bays, Carter**, (**56** #5405)
- Khare, S. P.** See **Gupta, Hansraj**, **56** #11877
- Kožežel' dinov, S. Š.** Some properties of the squares of multidigit numbers. (Russian) **56** #8470
- Mairson, Harry G.** Some new upper bounds on the generation of prime numbers. (**56** #4236)
- Manders, Kenneth** (with Adleman, Leonard) NP-complete decision problems for quadratic polynomials. (**55** #11710)
- Matthew, G.** (with Williams, H. C.) Some new primes of the form  $k \cdot 2^n + 1$ . **55** #12605
- Morgenstern, J.** Transformations de Fourier discrètes. **56** #226
- Solovay, Robert M.** (with Strassen, Volker) A fast Monte-Carlo test for primality. (**55** #2732)
- Strassen, Volker** See **Solovay, Robert M.**, (**55** #2732)
- (Venkov, B. B.) See **Computations in algebra and number theory**, (**56** #15248)
- Williams, H. C.** See **Matthew, G.**, **55** #12605
- Yates, Samuel** ★Prime period lengths. **55** #2716
- Algebra** See **Computations in algebra and number theory**, (**56** #15248)
- Computations in algebra and number theory** ★Вычисления в алгебре и теория чисел. (Russian) [Computations in algebra and number theory] (**56** #15248)
- Number theory** See **Computations in algebra and number theory**, (**56** #15248)
- Tables:**
- Prime period lengths See **Yates, Samuel**, **55** #2716

### 10–06 Collections of papers; proceedings of conferences

- (Amice, Yvette) See **Groupe d'Étude d'Analyse Ultramétrique**, (**56** #13)
- (Delange, Hubert) See **Séminaire: Delange-Pisot-Poitou**, **56** #227 and **Séminaire: Delange-Pisot-Poitou**, **56** #228
- (Malyšev, A. V.) See **Investigations in the theory of numbers**, **56** #8471 and **Studies in number theory (LOMI)**, **55** #10362
- (Mann, H. B.) See **Number theory and algebra**, (**56** #11675)
- (Pisot, Ch.) See **Séminaire: Delange-Pisot-Poitou**, **56** #227 and **Séminaire: Delange-Pisot-Poitou**, **56** #228
- (Poitou, Georges) See **Séminaire: Delange-Pisot-Poitou**, **56** #227 and **Séminaire: Delange-Pisot-Poitou**, **56** #228
- (Robba, Philippe) See **Groupe d'Étude d'Analyse Ultramétrique**, (**56** #13)
- (Ross, Arnold E.) See **Number theory and algebra**, (**56** #11675)
- (Tausky, Olga) See **Number theory and algebra**, (**56** #11675)
- (Turán, Pál) See **Topics in number theory**, **55** #2718
- (Zassenhaus, Hans J.) See **Number theory and algebra**, (**56** #11675)
- Algebra** See **Number theory and algebra**, (**56** #11675)
- Arithmetic functions** See **Characteristics of arithmetic functions**, **55** #12606
- Characteristics of arithmetic functions** ★Suri teki kansu no tokusei. (Japanese) [Characteristics of arithmetic functions] **55** #12606
- Colloquium:**
- Number Theory** See **Topics in number theory**, **55** #2718
- Groupe d'Étude d'Analyse Ultramétrique** ★Groupe d'Étude d'Analyse Ultramétrique. 3e année: 1975/76. (**56** #13)
- Investigations in the theory of numbers** ★Investigations in the theory of numbers. 2. **56** #8471
- Journées:**
- Analyse Ultramétrique** See **Groupe d'Étude d'Analyse Ultramétrique**, (**56** #13)
- Kyoto** See **Characteristics of arithmetic functions**, **55** #12606; **Research on theory of**



- numbers, 56 #11878 and Research on microlocal analysis, (56 #13245)  
 Marseille-Luminy See Groupe d'Étude d'Analyse Ultramétrique, (56 #13)  
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 Characteristics of Arithmetic Functions See Characteristics of arithmetic functions, 55 #12606  
 Research on Microlocal Analysis See Research on microlocal analysis, (56 #13245)  
 Research on Theory of Numbers See Research on theory of numbers, 56 #11878  
 Theory of numbers See Research on theory of numbers, 56 #11878  
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 Ultrametric analysis See Groupe d'Étude d'Analyse Ultramétrique, (56 #13)

### 10Axx Elementary number theory [For analogues in number fields, see 12A05.]

- Alladi, Krishnaswami ★Contributions to number theory. 55 #5506  
 Apostol, Tom M. ★Introduction to analytic number theory. (55 #7892)  
 10A05 Multiplicative structure of the integers (GCD, etc.)  
 Vélez, William Yslas Some remarks on a number theoretic problem of Graham. 55 #2719  
 10A10 Congruences, primitive roots  
 Berndt, Bruce C. Classical theorems on quadratic residues. (56 #229)  
 Bijašev, R. G. Detection and correction of a binary error in a nonpositional code. (Russian) (56 #11507)  
 Frei-Imfeld, Günther Über Kongruenzen höherer Operationen. 55 #2720  
 Friedlander, John B. (with Rosen, Kenneth H.) Refinements of a congruence of Gauss. 56 #8472  
 Heldrich, Arnošt J. J. On finite differences, permutations, and quadratic residues. 56 #11879  
 Hewitt, E. Certain congruences that hold identically. 55 #7896  
 Ivić, Aleksandar On an arithmetical semigroup connected with quadratic residues. 55 #2721  
 Johnson, Wells On congruences related to the first case of Fermat's last theorem. (56 #5423)  
 Kløve, Torleiv A generalization of Euler's theorem. 55 #244  
 McCarthy, Paul J. The number of restricted solutions of some systems of linear congruences. (55 #12630)  
 Patrizio, Serafino Generalizzazione del teorema di Wilson alle terne prime. (French summary) 55 #251  
 Rosen, Kenneth H. See Friedlander, John B., 56 #8472  
 Šestakova, K. O. On the generalization of a theorem of Euler. (Ukrainian. German and Russian summaries) (55 #12624)  
 Small, Charles Powers mod  $n$ . 55 #10363

### 10A15 Power residues, reciprocity

- Berndt, Bruce C. Classical theorems on quadratic residues. 56 #229  
 Cenacchi, G. (with De Matteis, A.) Quasi-random sequences by power residues. (55 #11558)  
 Chowla, S. (with Hartung, Paul) The reciprocity formula for Dedekind sums. (55 #12608)  
 Collison, Mary Joan The origins of the cubic and biquadratic reciprocity laws. (56 #52)  
 De Matteis, A. See Cenacchi, G., (55 #11558)  
 Hartung, Paul See Chowla, S., (55 #12608)  
 Matthews, K. R. An example from power residues of the critical problem of Crapo and Rota. 55 #10364  
 Schinzel, André Les résidus de puissances et les congruences exponentielles. (56 #5488)  
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 Vegh, Emanuel  $k$ th-power residue chains. 55 #10365  
 Williams, Kenneth S. Note on Burde's rational biquadratic reciprocity law. 56 #5400  
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### 10A20 Number-theoretic functions, related numbers; inversion formulas

- Alladi, Krishnaswami On arithmetic functions and divisors of higher order. 55 #12607  
 (with Erdős, Paul) On an additive arithmetic function. 56 #5401  
 Barkan, Philippe Sur les sommes de Dedekind et les fractions continues finies. (English summary) 55 #7897  
 Belgy, J.-N. Fonctions arithmétiques. 55 #10366  
 Berndt, Bruce C. Reciprocity theorems for Dedekind sums and generalizations. 55 #2722

- Bhattacharjya, G. (with Gupta, Hansraj) A sum involving the greatest integer function. 56 #11881  
 Botteri, Vinko Some sums involving fractional parts or  $\{x\}$ . 56 #8473  
 Bundschuh, P.  $p$ -adische Kettenbrüche und Irrationalität  $p$ -adischer Zahlen. 56 #11882  
 Buschman, R. G. See Guerin, E. E., 55 #2724  
 Chidambaraswamy, J. Series involving the reciprocals of generalized totients. 56 #15538  
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 Ewell, John A. Recurrences for the sum of divisors. 56 #230  
 Gervois, Annie See Derrida, Bernard; et al., 55 #12609  
 Guerin, E. E. (with Buschman, R. G.) Elementary proofs of statements equivalent to the prime number theorem. 55 #2724  
 Gupta, Hansraj Use of inverse functions in summation. 55 #12610  
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 Halász, G. Remarks to the talk of Mr. I. Ruzsa: "General multiplicative functions" (Topics in number theory, pp. 281-285, Colloq. Math. Soc. János Bolyai, Vol. 13, North-Holland, Amsterdam, 1976). 55 #12619  
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## 10Kxx Probabilistic theory; measure, dimension, etc.

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- Grandet-Hugot, Marthe Quelques résultats concernant l'équirépartition dans l'anneau des adèles d'un corps de nombres algébriques. (**55** #12674a)  
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- Katz, Nicholas M. Formal groups and  $p$ -adic interpolation. **56** #319
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- Diarra, Bertin** Modules de Banach sur l'algèbre des mesures  $p$ -adiques d'un groupe compact totalement discontinu. **56** #11969  
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- Brenner, J. L.** (with Carlitz, Leonard) Covering theorems for finite nonabelian simple groups. III. Solutions of the equation  $\alpha x^2 + \beta t^2 + \gamma t^{-2} = a$  in a finite field. **(56** #15754)
- Carlitz, Leonard** (with Long, Andrew F., Jr.) The factorization of  $Q(L(x_1), \dots, L(x_k))$  over a finite field where  $Q(x_1, \dots, x_k)$  is of first degree and  $L(x)$  is linear. **55** #5595  
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 See also **Brenner, J. L.**, **(56** #15754)
- Claesen, H. L.** The group of units in  $GF(q)[x]/(a(x))$ . **56** #11971
- Gordon, J. A.** Very simple method to find the minimum polynomial of an arbitrary nonzero element of a finite field. **56** #11972
- Helleseth, Tor** Some results about the cross-correlation function between two maximal linear sequences. **(55** #2341)
- Judanina, A. B.** Tensorial generalizations of radical codes. (Russian) **(56** #11513)
- Kautschitsch, Hermann** Über vertauschbare Polynome mit vorgegebenen Gradzahlen. **(55** #2860)
- Long, Andrew F., Jr.** (with Vaughan, Theresa P.) Factorization of  $Q(h(T)(x))$  over a finite field, where  $Q(x)$  is irreducible and  $h(T)(x)$  is linear. II. **56** #326  
 See also **Carlitz, Leonard**, **55** #5595
- Mignotte, Maurice** Factorisation des polynômes sur un corps fini. **55** #12708
- Mullen, Gary L.** Permutation polynomials in several variables over finite fields. **55** #313  
 Equivalence classes of polynomials over finite fields. **55** #312
- Sergeev, E. A.** The splitting of the polynomials  $f_n(x)$  over finite fields. (Russian) **56** #2970
- Tu, Kuei Chang** The structure of  $Q$ -matrices and the reducibility of polynomials over a Galois field. (Chinese) **56** #327
- Vaughan, Theresa P.** See **Long, Andrew F., Jr.**, **56** #326
- West, Karen I.** See **Beard, Jacob T. B., Jr.**, **55** #310

- Nöbauer, W.** Compatible and conservative functions on residue-class rings of the integers. **55** #12709
- Reed, Irving S.** (with Truong, T. K.) Convolutions over residue classes of quadratic integers. **55** #8010
- Small, Charles** Solution of Waring's problem mod  $n$ . **(55** #12671)
- Stepanov, S. A.** Equations over finite fields. (Russian) **(55** #12725)
- Truong, T. K.** See **Reed, Irving S.**, **55** #8010
- Topics in number theory** See **Nöbauer, W.**, **55** #12709

## 12C20 Cyclotomy

- Morgan, Elizabeth J.** (with Street, Anne Penfold; Wallis, Jennifer Seberry) Designs from cyclotomy. **(55** #130)
- Perel'muter, G. I.** Estimation of a multiple sum with the Legendre symbol for a polynomial of odd degree. (Russian) **(56** #3019)
- Street, Anne Penfold** See **Morgan, Elizabeth J.; et al.**, **(55** #130)
- Wallis, Jennifer Seberry** See **Morgan, Elizabeth J.; et al.**, **(55** #130)

## 12C25 Exponential sums

- Carlitz, Leonard** A theorem on linear exponential sums. **56** #11973

## 12C30 Structure theory

- Abian, Alexander** (with Floyd, D. R.) Rings satisfying Wilson's equality. **56** #328
- Elizarov, V. P.** Finite rings. (Russian) **(55** #10514)
- Floyd, D. R.** See **Abian, Alexander**, **56** #328

## 12C99 None of the above, but in this section

- Reed, Irving S.** (with Truong, T. K.) Complex integer convolutions over a direct sum of Galois fields. **55** #8011
- Truong, T. K.** See **Reed, Irving S.**, **55** #8011

## 12Dxx Real and complex fields

### 12D05 Polynomials: factorization

- Tang, I.** When do polynomials have imaginary roots? **56** #5512
- Yang, Chung Chun** A problem on polynomials. **56** #15620

### 12D10 Polynomials: location of zeros [Algebraic theorems; for the analytic theory, see 26A78, 30A08.]

- Ahn, S. M.** See **Jury, Eliahu I.**, **55** #5598
- Connes, Alain** Ordres faibles et localisation de zéros de polynômes. **55** #5596
- Hasquenoph, Jean-Marie** Localisation des zéros de polynômes par rapport au cercle unité. **55** #5597
- Jury, Eliahu I.** (with Ahn, S. M.) Remarks on the root-clustering of a polynomial in a certain region in the complex plane. **55** #5598
- Pinkert, James R.** An exact method for finding the roots of a complex polynomial. **(56** #299)
- Quine, J. R.** The geometry of  $p(S^1)$ . **(56** #589)
- Zaheer, Neyamat** On composite abstract homogeneous polynomials. **55** #2857

### 12D15 Formally real fields

- Arason, Jón K.** (with Pfister, Albrecht) Zur Theorie der quadratischen Formen über formalreellen Körpern. **(55** #5529)
- Brown, Ron** Superpythagorean fields. **(55** #320)
- Fine, Benjamin** Sum of squares rings. **(55** #8023)
- Geyer, Wulf-Dieter** (with Martens, G.) Überlagerungen berandeter Kleinscher Flächen. **(56** #3021)
- Gondard, Danielle** (with Ribenboim, Paulo) Fonctions définies positives sur les variétés réelles. **55** #5601  
 (with Ribenboim, Paulo) Le 17<sup>e</sup> problème de Hilbert pour les matrices. **55** #5600
- Iozapavičius, A. È.** (with Mihalev, A. V.) Modules with quadratic and bilinear forms. (Russian) **(56** #5427)
- Knebusch, Manfred** On algebraic curves over real closed fields. II. **(56** #368)  
 Berichtigung zu der Arbeit: "On algebraic curves over real closed fields" (Math. Z. **150** (1976), no. 1, 49–70). **(56** #12011)
- Marshall, M.** Some local-global principles for formally real fields. **(55** #12634)
- Martens, G.** See **Geyer, Wulf-Dieter**, **(56** #3021)
- Mihalev, A. V.** See **Iozapavičius, A. È.**, **(56** #5427)
- Mostowski, Tadeusz** Analytic applications of decidability theorems. (Polish) **(56** #5518)
- Pfister, Albrecht** See **Arason, Jón K.**, **(55** #5529)
- Procesi, Claudio** (with Schacher, Murray) A non-commutative real Nullstellensatz and Hilbert's 17th problem. **55** #5599
- Ribenboim, Paulo** See **Gondard, Danielle**, **55** #5601 and **Gondard, Danielle**, **55** #5600
- Schacher, Murray** See **Procesi, Claudio**, **55** #5599
- Waterhouse, William C.** Self-adjoint operators and formally real fields. **(55** #12637)

## 12D99 None of the above, but in this section

- Berți, Șt.** (with Burlacu, Eugen) Quelques considérations concernant les relations binaires complexes. **56** #329
- Burlacu, Eugen** See **Berți, Șt.**, **56** #329
- Esterle, Jean** Solution d'un problème d'Erdős, Gillman et Henriksen et application à l'étude des homomorphismes de  $\mathcal{C}(K)$ . **(56** #3787)



- Montgomery, Hugh L. Polynomials in many variables. **56** #11974  
 Risler, Jean-Jacques Division des fonctions de classe  $\mathcal{C}$  par les fonctions analytiques réelles. (English summary) **(56)** #16671

## 12Exx General field theory

- Kuroš, A. G. ★Ecuaciones algebraicas de grados arbitrarios. (Spanish) [Algebraic equations of arbitrary degrees] **55** #5602  
 Procesi, Claudio ★Teoría de Galois elemental. (Spanish) [Elementary Galois theory] **55** #2858  
 (de Sepulveda, Silvia) See Kuroš, A. G., **55** #5602

### 12E05 Polynomials (irreducibility, etc.)

- Corzatt, Clifton E. Permutation polynomials over the rational numbers. **55** #316  
 Erastov, K. D. The unsolvability by ruler and compass of algebraic equations of degree greater than two. (Russian) **55** #315  
 Erdős, Paul (with Fajtlowicz, Siemion) On composition of polynomials. **56** #330  
 Fajtlowicz, Siemion See Erdős, Paul, **56** #330  
 Fried, Michael D. Arithmetical properties of function fields. II. The generalized Schur problem. **(56)** #2968  
 Liu, Ruey Wen (with Seguin, Gerald E.) Relative primeness of two polynomials. **56** #331  
 Ostrowski, A. M. The irreducibility of the resultant and connected irreducibility theorems. **56** #15621  
 Schinzel, André A general irreducibility criterion. **55** #2859  
 Seguin, Gerald E. See Liu, Ruey Wen, **56** #331  
 Smith, John Howard General trinomials having symmetric Galois group. **55** #10433

### 12E10 Special polynomials

- Eckmann, J.-P. On the computation of the Galois group over the quotient field of  $\mathbb{C}[\lambda]$ . **(56)** #2954  
 Erastov, K. D. The unsolvability of binomial equations by means of an instrument that divides an angle into  $m$  equal parts. (Russian) **55** #317  
 Györy, K. Polynomials with given discriminant. **55** #12710  
 Kautschitsch, Hermann Über vertauschbare Polynome mit vorgegebenen Gradzahlen. **55** #2860  
 Liardet, Pierre Résultats de stabilité algébrique. **56** #332  
 Rollero, Aldo Sui discriminanti delle equazioni dei gradi 5, 6. (English and French summaries) **56** #2971  
 Topics in number theory See Györy, K., **55** #12710

### 12E99 None of the above, but in this section

- Baston, V. J. (with Bostock, F. A.) Copying configurations in algebraic extensions of prime fields. **(55)** #2618  
 Bernšteín, D. N. The number of roots of a system of equations. (Russian) **(55)** #8034  
 Bostock, F. A. See Baston, V. J., **(55)** #2618  
 Bur'jan, V. Ju. A generalization of Hermite's method for the Tschirnhaus transformation. (Russian) **56** #15622  
 Kuhn, Harold W. A new proof of the fundamental theorem of algebra. **55** #2861

## 12Fxx Field extensions

### 12F05 Algebraic extensions

- Bass, Hyman (with Tate, J. T.) The Milnor ring of a global field. **(56)** #449  
 Evans, R. J. (with Isaacs, I. M.) Fields generated by linear combinations of roots of unity. **55** #10434  
 Isaacs, I. M. See Evans, R. J., **55** #10434  
 Russell, Peter Good and bad field generators. **56** #2977  
 Tate, J. T. See Bass, Hyman, **(56)** #449

### 12F10 Separable extensions, Galois theory

- Bačurskaja, A. F. The group of certain equations. (Russian) **56** #2972  
 Equations with a regular group. (Russian) **56** #2973  
 Endler, Otto (with Engler, Antonio José) Fields with Henselian valuation rings. **55** #318  
 Engler, Antonio José See Endler, Otto, **55** #318  
 Kurbatov, V. A. Galois extensions of prime degree and their primitive elements. (Russian) **56** #2974  
 Martens, G. Kummertheorie reeller Funktionenkörper einer Variablen. **(56)** #8581  
 Sergeev, É. A. The Galois group of a class of equations. (Russian) **56** #2975  
 Takeuchi, Mitsuhiro On  $k_s/k$ -Galois theory for fields. **55** #2862  
 Verma, R. U. A remark on Galois theory. (Spanish. English translation) **55** #12711

### 12F15 Inseparable extensions, derivations

- Callahan, F. P. An identity satisfied by derivations of a purely inseparable field. **56** #8544  
 Kinoshita, Hisae Forms and extensions in a purely inseparable extension. **55** #2863  
 Takeuchi, Mitsuhiro A characterization of the Galois subalgebras  $H_k(K/F)$ . **56** #5513

### 12F20 Transcendental extensions

- Colliot-Thélène, Jean-Louis (with Sansuc, Jean-Jacques) La  $R$ -équivalence sur les tores. **(56)** #8576

- Deveney, James K. Generalized primitive elements for transcendental field extensions. **56** #2976  
 Sansuc, Jean-Jacques See Colliot-Thélène, Jean-Louis, **(56)** #8576  
 Vámos, P. The Nullstellensatz and tensor products of fields. **56** #15623

### 12F99 None of the above, but in this section

- Jarden, Moshe (with Kiehne, Ursel) The elementary theory of algebraic fields of finite corank. **55** #8012  
 The elementary theory of  $\omega$ -free  $Ax$  fields. **55** #8013  
 Kiehne, Ursel See Jarden, Moshe, **55** #8012  
 Sharp, Rodney Y. The dimension of the tensor product of two field extensions. **55** #10435  
 Simplifications in the theory of tensor products of field extensions. **(55)** #8026

## 12Gxx Homological methods

### 12G05 Galois cohomology [See also 12A60, 18H10.]

- Douai, Jean-Claude Cohomologie des schémas en groupes semi-simples sur les anneaux de Dedekind et sur les courbes lisses, complètes, irréductibles. (English summary) **56** #2978  
 Neumann, Olaf Über Lokalisierungen der Kohomologie proendlicher Gruppen. **55** #5603

### 12G10 Cohomological dimension

### 12G99 None of the above, but in this section

- Fein, Burton (with Schacher, Murray) Ulm invariants of the Brauer group of a field. **(56)** #15615  
 Jančevskii, V. I. Division algebras over Henselian discretely valued fields. (Russian) **(55)** #5685  
 Schacher, Murray See Fein, Burton, **(56)** #15615

## 12Hxx Differential and difference algebra

### 12H05 Differential algebra

- Brownawell, W. Dale (with Kubota, K. K.) The algebraic independence of Weierstrass functions and some related numbers. **(56)** #2932  
 Kubota, K. K. See Brownawell, W. Dale, **(56)** #2932  
 Matsuda, Michihiko Liouville's theorem on a transcendental equation  $\log y = y/x$ . **55** #2864  
 An application of Ritt's low power theorem. **56** #15624  
 Rosenlicht, Maxwell On Liouville's theory of elementary functions. **56** #5514  
 Sokolov, P. V. One characterization of rings of polynomials over a field. (Russian) **56** #2979  
 Wood, Carol The model theory of differential fields revisited. **(56)** #15414

### 12H10 Difference algebra

## 12Jxx Topological fields

### 12J05 Normed fields

### 12J10 Valued fields

- Berrondo, François Sur le corps des fractions d'un anneau de séries formelles généralisées. (English summary) **(55)** #12719  
 Botteri, V. Sur une espèce de familles de l'anneau de valuation. (Serbo-Croatian summary) **55** #5604  
 Cohen, Jo-Ann See Nichols, Elizabeth, **56** #15625  
 Jain, D. R. See Jain, Pawan Kumar, **55** #319  
 Jain, Pawan Kumar (with Jain, D. R.) Simultaneous automorphisms in the space of entire functions over non-Archimedean fields. (Serbo-Croatian summary) **55** #319  
 Nichols, Elizabeth (with Cohen, Jo-Ann) Locally bounded topologies on global fields. **56** #15625  
 Weispfenning, Volker On the elementary theory of Hensel fields. **(55)** #5437  
 Yadav, Ram Avtar Witt ring of Henselian valued fields of rank  $r > 1$ . (Italian summary) **(55)** #7916

### 12J15 Ordered fields

- Brown, Ron Superpythagorean fields. **55** #320  
 Dieudonné, J. A. Sur les automorphismes des corps algébriquement clos. **55** #321  
 Holland, Samuel S., Jr. Orderings and square roots in  $\ast$ -fields. **56** #5515  
 Profke, Lothar Von  $\mathbb{R}$  verschiedene Modelle der Freudenthalschen Axiome vom Rechenschieber und vom Winkelmesser. **56** #11975  
 Rayner, Francis J. Ordered fields. **55** #10436

### 12J20 General valuation theory

- Sangare, Daouda Sur la composition des filtrations et des pseudo-valuations. (English summary) **55** #2865

### 12J99 None of the above, but in this section

- Berrondo, François Corps topologiques linéaires non localement bornés et complets. (English summary) **55** #5605



- Čilin, V. I. *See* Sarymsakov, T. A.; et al., **56** #5516  
 Klaua, Dieter Intervallstrukturen geordneter Körper. (**56** #13584)  
 Rubšteín, B. A. *See* Sarymsakov, T. A.; et al., **56** #5516  
 Sarymsakov, T. A. (with Rubšteín, B. A.; Čilin, V. I.) Complete tensor products of topological Boolean algebras and semifields. (Russian) **56** #5516  
 Weber, Hans Ringtopologien auf  $\mathbb{Z}$  und  $\mathbb{Q}$ . **56** #5517

## 12K05 Near-fields and other generalizations

- Ajupov, Š. A. Topology of  $C$ -convergence in semifields. (Russian. Uzbek summary) (**55** #8748)  
 Bureš, Jarolím (with Klouda, Josef) One generalization of quasifield. (Russian summary) (**55** #3957)  
 Klouda, Josef *See* Bureš, Jarolím, (**55** #3957)  
 Komori, Yuichi A relation between strongly regular rings and pseudo-fields. (**56** #408)  
 Wähling, Heinz Ein Zassenhauskriterium für unendliche Fastkörper. **55** #12712  
 Beispiel eines projektiven Fastkörpers mit nicht-projektiven Teilfastkörpern. **56** #2980

## 12Lxx Connections with logic

### 12L05 Decidability

- Kreczmar, Antoni On infinite sets of polynomial relations. (Russian summary) (**56** #5277)  
 Mostowski, Tadeusz Analytic applications of decidability theorems. (Polish) **56** #5518  
 Weispfenning, Volker On the elementary theory of Hensel fields. (**55** #5437)

### 12L10 Ultraproducts

- Diarra, Bertin Ultra-produits de corps munis d'une valeur absolue ultra-métrique. (English summary) (**56** #2816)  
 Jarden, Moshe (with Kiehne, Ursel) The elementary theory of algebraic fields of finite corank. (**55** #8012)  
 The elementary theory of  $\omega$ -free  $Ax$  fields. (**55** #8013)  
 Kiehne, Ursel *See* Jarden, Moshe, (**55** #8012)

### 12L15 Nonstandard arithmetic [See also 02H25.]

- Cherlin, Gregory L. Ideals of integers in nonstandard number fields. (**55** #7768)  
 Robinson, Abraham Nonstandard arithmetic and generic arithmetic. (**56** #5283)

### 12L99 None of the above, but in this section

- Hodges, Wilfrid On the effectivity of some field constructions. (**55** #10252)

## 13-XX COMMUTATIVE RINGS AND ALGEBRAS [For finite commutative rings, see 12Cxx.]

- Kaplansky, Irving ★Topics in commutative ring theory. **55** #322

### 13-01 Elementary exposition (collegiate level)

- Renschuch, Bodo ★Elementare und praktische Idealtheorie. **56** #2981

### 13-02 Advanced exposition (research surveys, etc.)

- (Anderson, Daniel) *See* Murthy, M. Pavaman, **56** #11976  
 Gilmer, Robert ★Multiplicative ideal theory. **55** #323  
 Lazard, Daniel Algorithmes fondamentaux en algèbre commutative. (**55** #12713)  
 Murthy, M. Pavaman ★Commutative algebra. Vol. II. **56** #11976  
 Vasconcelos, Wolmer V. ★The rings of dimension two. **55** #324

### 13-03 Historical

### 13-04 Explicit machine computation and programs (not the theory of computation or programming)

### 13-06 Collections of papers; proceedings of conferences

- (Borevič, Z. I.) *See* Rings and modules, **55** #2866 and Modules and representations, **56** #11977  
 (Skopin, A. I.) *See* Rings and modules, **55** #2866 and Modules and representations, **56** #11977

#### Colloque:

- Algèbre Commutative ★Colloque d'Algèbre Commutative. **55** #325  
 Commutative algebra *See* Colloque: Algèbre Commutative, **55** #325  
 Modules *See* Rings and modules, **55** #2866  
 Modules and representations ★Модули и представления. (Russian) [Modules and representations] **56** #11977  
 Representations *See* Modules and representations, **56** #11977  
 Rings and modules ★Кольца и модули. (Russian) [Rings and modules] **55** #2866

## 13Axx General commutative ring theory

### 13A05 Divisibility

### 13A10 Radical theory

### 13A15 Ideals, prime ideals, valuations and generalizations

- Bouvier, Alain Sur les idéaux premiers de hauteur 1 d'un anneau de Krull. (English summary) (**55** #5615)  
 Davis, Edward D. *See* McAdam, Stephen, **56** #2983  
 Fritzsche, Volkmar Eine Methode zur Berechnung von allgemeinen Nullstellen eines Primideals. (Russian, English and French summaries) (**55** #346)  
 Gilmer, Robert (with Heinzer, William) Cardinality of generating sets for ideals of a commutative ring. **56** #2982  
 Hache, Jordane Idéaux premiers d'un anneau de Bezout et d'un domaine pseudo-bezoutien. (English summary) **55** #326  
 Heinzer, William *See* Gilmer, Robert, **56** #2982  
 Jacob, Geneviève Polynômes représentant la fonction nulle sur un anneau commutatif unitaire. (English summary) **55** #327  
 Kuan, Wei Eihn Some results on normality of a graded ring. **55** #328  
 Lestmann, Phillip Simple going down in PI rings. **55** #5606  
 McAdam, Stephen (with Davis, Edward D.) Prime divisors and saturated chains. **56** #2983  
*See also* Ratliff, L. J., Jr., **55** #10438a  
 Năstăsescu, Constantin Punti isolati nello spettro minimale di un anello. (French summary) **55** #2867  
 Collegamento tra il reticolo degli ideali di un anello e il suo spettro. (English summary) **55** #2868  
 Perić, Veselin Über halbprimäre Ideale und halbprimäre Ringe. **55** #10437  
 Picavet, Gabriel Idéaux premiers de Goldman. **56** #5519  
 Ratliff, L. J., Jr. On prime divisors of  $I^n$ ,  $n$  large. **56** #15626  
 (with McAdam, Stephen) Maximal chains of prime ideals in integral extension domains. I. **55** #10438a  
 Maximal chains of prime ideals in integral extension domains. II. **55** #10438b  
 Characterizations of taut semi-local rings. **55** #10439  
 Renschuch, Bodo Beiträge zur konstruktiven Theorie der Polynomideale. VII. Beispiele Veronesischer Projektionsvarietäten. (Russian and English summaries) (**56** #12019a)  
 Beiträge zur konstruktiven Theorie der Polynomideale. VIII. Basisbestimmung von primen  $H$ -Idealen mit vorgegebenen rationalen allgemeinen Nullstellen aus den Hilbertschen Gleichungen. (Russian and English summaries) (**56** #12019b)  
 Beiträge zur konstruktiven Theorie der Polynomideale. IX. Basisdarstellungen inhomogener Polynomideale. (Russian and English summaries) (**56** #12019c)  
 Beiträge zur konstruktiven Theorie der Polynomideale. X. Basisdarstellungen Vahlenscher Kurven und allgemeiner rationaler Raumkurven. (Russian and English summaries) (**56** #12019d)  
 Beiträge zur konstruktiven Theorie der Polynomideale. XI. Aufstellung der Hilbertschen Gleichungen für  $H$ -Ideale bei vorgegebener Basis. (Russian and English summaries) (**56** #12019e)  
 Beiträge zur konstruktiven Theorie der Polynomideale. XII. Zur Berechnung von Eliminationsidealen. (Russian and English summaries) (**56** #12019f)  
 Sangare, Daouda Sur la composition des filtrations et des pseudo-valuations. (English summary) (**55** #2865)

### 13A20 Brauer group [See also 16A16.]

- Beattie, Margaret A direct sum decomposition for the Brauer group of  $H$ -module algebras. **56** #333  
 Childs, Lindsay N. On Brauer groups of some normal local rings. **55** #5607  
 Garfinkel, Gerald S. A module approach to the Chase-Rosenberg-Zelinsky sequences. **55** #8014  
 Knus, M. A. (with Ojanguren, M.; Saltman, David J.) On Brauer groups in characteristic  $p$ . **55** #2869  
 Ojanguren, M. *See* Knus, M. A.; et al., **55** #2869  
 Orzech, Morris (with Small, Charles) ★The Brauer group of commutative rings. **56** #15627  
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 Saltman, David J. *See* Knus, M. A.; et al., **55** #2869  
 Small, Charles *See* Orzech, Morris, **56** #15627  
 Zelinsky, Daniel Long exact sequences and the Brauer group. **55** #5608  
 Brauer groups. **56** #2984

### 13A99 None of the above, but in this section

- Cornish, William H. Commutative regular rings. (**55** #2984)  
 Lazard, Daniel Algorithmes fondamentaux en algèbre commutative. **55** #12713  
 Wadsworth, Adrian R. Hilbert subalgebras of finitely generated algebras. **55** #329

## 13Bxx Ring extensions and related topics

### 13B05 Galois theory

- Borevič, A. Z. The Brauer imbedding problem for commutative rings. (Russian) **56** #11978  
 Cox, S. H., Jr. The preparation theorem and the freeness of  $A[[X]]/I$ . (**55** #351)  
 Knebusch, Manfred Real closures of commutative rings. II. **55** #2870  
 Parimala, S. (with Sridharan, R.) Projective modules over quaternion algebras. (**56** #5652)  
 Roark, Charles Winfred Separable criteria for  $G$ -diagrams over commutative rings. (**55** #10533)  
 Sridharan, R. *See* Parimala, S., (**56** #5652)  
 (Venkov, B. B.) *See* Modules and homology in group theory and Galois theory, (**56** #8717)  
 Galois theory *See* Modules and homology in group theory and Galois theory, (**56** #8717)  
 Group theory *See* Modules and homology in group theory and Galois theory, (**56** #8717)  
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## 13B10 Automorphisms and derivations

- (Brown, W. C.) See Kuan, Wei Eihn, 55 #8015  
 Endô, Akira Finite automorphism groups of restricted formal power series rings. II. 56 #11979  
 Fried, E. Automorphism group of integral domains fixing a given subring. 56 #2985  
 Gerstenhaber, Murray The fundamental form of an inseparable extension. 55 #2871  
 Kuan, Wei Eihn An addendum to: "Ideals and higher derivations in commutative rings" (Canad. J. Math. 24 (1972), 400-415) by W. C. Brown and Kuan. 55 #8015  
 Kühner, J. Über Separabilität und Automorphismengruppen kommutativer Ringe. 55 #12714  
 Lantz, David C.  $R$ -automorphisms of  $R[G]$  for  $G$  abelian torsion-free. (55 #8022)

## 13B15 Ramification theory

- Querré, Julien Sur un théorème de Mori-Nagata. (English summary) 56 #2986

## 13B20 Integral dependence; integral closure; integrally closed rings, related rings (Japanese, etc.)

- Burton, Richard G. Integral closure in multiplicative lattices. (55 #209)  
 Dobbs, David E. Ascent and descent of going-down rings for integral extensions. 55 #330  
 Gilmer, Robert A note on the integral closure of a Dedekind domain. 56 #8546  
 Ischebeck, Friedrich Zwei Bemerkungen über seminormale Ringe. (55 #5625)  
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 Katz, Nicholas M. Formal groups and  $p$ -adic interpolation. (56 #319)  
 Kirillov, A. N. Commutative formal groups. (Russian) (56 #15664)  
 Konovalov, G. T. The universal  $G$ -norms of formal groups over a local field. (Russian) (55 #12735a)  
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### 14L10 Group varieties

- Ax, James Transcendence and differential algebraic geometry. (56 #15648)  
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 Iversen, Birger Brauer group of a linear algebraic group. (55 #12736)  
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### 14L15 Group schemes

- Cline, Edward (with Parshall, Brian; Scott, Leonard L.; van der Kallen, Wilberd) Rational and generic cohomology. (55 #12737)  
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 Meyer, Hanns-Martin (with Oberst, Ulrich) Fixpunkt- und Struktursätze für affine, algebraische Gruppenschemata in Charakteristik  $p$ . (55 #2936)  
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### 14L20 Finite group schemes

- Kouider, Mekkia Groupes formels isogènes à un groupe donné. (English summary) (56 #374)

### 14L25 Pro-algebraic group schemes

### 14L99 None of the above, but in this section

- Carayol, Henri Le degré de symétrie d'une variété algébrique. (55 #5648)  
 Fauntleroy, Amassa Linear  $G_a$  actions on affine spaces and associated rings of invariants. (56 #5583)  
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 Hochschild, G. Automorphism groups of complex Lie algebras. (55 #2938)  
 Magid, Andy R. Factoriality in quotients of linear  $G_m$ -actions. (56 #3029)  
 Mount, Kenneth R. See Hipps, N.; et al., (55 #12723)  
 Oberst, Ulrich Affine Quotientenschemata nach affinen, algebraischen Gruppen und induzierte Darstellungen. (56 #3030)  
 Popov, V. L. Classification of the spinors of dimension fourteen. (Russian) (55 #10389)  
 Richardson, R. W. Affine coset spaces of reductive algebraic groups. (55 #10473)  
 Villamayor, O. E. See Hipps, N.; et al., (55 #12723)  
 Waterhouse, William C. Class groups of rings of invariants. (56 #11999)

## 14Mxx Special varieties

### 14M05 Varieties defined by ring conditions (factorial, Macaulay)

- Gallarati, D. Problemi di completa interferenza in geometria algebrica. (English summary) (55 #12739)  
 Goto, Shiro (with Suzuki, Naoyoshi; Watanabe, Keiichi) On affine semigroup rings. (56 #8553)  
 (with Watanabe, Keiichi) The structure of one-dimensional  $F$ -pure rings. (56 #11989)  
 Hochster, Melvin Cohen-Macaulay rings, combinatorics, and simplicial complexes. (56 #376)  
 Mori, Shigefumi On affine cones associated with polarized varieties. (55 #12740)  
 Nesselmann, Dieter Über irreduzible Ideale in Gorenstein-Ringen. (Russian, English and French summaries) (55 #343)  
 Ostrowski, A. M. Algebraic closure of modules. (56 #11980)  
 Renschuch, Bodo Beiträge zur konstruktiven Theorie der Polynomideale. VII. Beispiele Veronesischer Projektionsvarietäten. (Russian and English summaries) (56 #12019a)  
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 Suzuki, Naoyoshi See Goto, Shiro; et al., (56 #8553)  
 Watanabe, Keiichi See Goto, Shiro; et al., (56 #8553) and Goto, Shiro, (56 #11989)

### 14M10 Complete intersections

- Anderson, Michael P. On some arithmetic properties of odd dimensional complete intersections. (55 #2914)  
 Berman, David Simplicity of a vector space of forms: finiteness of the number of complete Hilbert functions. (56 #8572)  
 Bingener, Jürgen Über die Divisorenklassengruppen lokaler Ringe. (56 #5553)  
 Brückmann, Peter Zur Kohomologie von vollständigen Durchschnitten mit Koeffizienten in der Garbe der Keime der Differentialformen. II. (56 #5581)  
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 Dimca, Alexandru The topology of complete intersections. I. (Romanian. English summary) (55 #2939)  
 Topology of complete intersections. II. (Romanian. English summary) (56 #5582)  
 Fauntleroy, Amassa Linear  $G_a$  actions on affine spaces and associated rings of invariants. (56 #5583)  
 Foxby, Hans-Bjørn Isomorphisms between complexes with applications to the homological theory of modules. (56 #5584)  
 Fritzsche, Volkmar Eine Methode zur Berechnung von allgemeinen Nullstellen eines Primideals. (Russian, English and French summaries) (55 #346)  
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 Murre, J. P. Algebraic hypersurfaces. (Dutch) (56 #377)  
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 Scheja, Günter (with Storch, Uwe) Addendum zu: "Quasi-Frobenius-Algebren und lokal vollständige Durchschnitte" (Manuscripta Math. 19 (1976), no. 1, 75–104). (55 #2940)  
 Sommese, Andrew John Theorems of Barth-Lefschetz type for complex subspaces of homogeneous complex manifolds. (55 #8422)  
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 Usui, Sampei Local Torelli theorem for non-singular complete intersections. (56 #8570)



**Winters, Gayn B.** Obstructed one dimensional local complete intersections. (55 #2901)  
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#### 14M15 Grassmannians, homogeneous spaces

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**Connolly, Frank** (*with* Nagano, Tadashi) The intersection pairing on a homogeneous Kähler manifold. (56 #9560)  
**Contou-Carrere, Carlos E.** Un modèle lisse d'un cycle de Schubert rendant localement libre l'image de son faisceau conormal dans le module des différentielles. (English summary) 55 #12741  
**Demazure, Michel** Automorphismes et déformations des variétés de Borel. 55 #8054  
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**Marlin, Roger** Anneaux de Grothendieck des variétés de drapeaux. 55 #10474  
**Nagano, Tadashi** *See* **Connolly, Frank**, (56 #9560)  
**Oproiu, V.** Some multiplication formulas in the cohomology ring of the Grassmann manifolds. (56 #1335)  
 Some non-embedding theorems for the Grassmann manifolds  $G_{2,n}$  and  $G_{3,n}$ . (56 #3870)  
**Papantonopoulou, Aigli** Curves in Grassmann varieties. 55 #10475  
**Parshall, Brian** *See* **Cline, Edward**; et al., (55 #12737)  
**Pourcin, Geneviève** Grassmanniennes de MacPherson. (55 #2891a)  
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#### 14M20 Rational varieties

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**Colliot-Thélène, Jean-Louis** (*with* Sansuc, Jean-Jacques) Variétés de première descente attachées aux variétés rationnelles. (English summary) (56 #5561)  
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**Coray, Daniel F.** Arithmetic on singular cubic surfaces. (55 #5636)  
**Edge, W. L.** Non-singular models of specialized Weddle surfaces. (55 #2923)  
**Glaz, S.** (*with* Sally, Judith D.; Vasconcelos, Wolmer V.) Lüroth's problem for rings. 55 #2942  
**Igusa, Jun-ichi** Exponential sums associated with a Freudenthal quartic. (56 #5455)  
**Iskovskih, V. A.** Birational automorphisms of three-dimensional algebraic varieties. (Russian) (56 #15657)  
**Miyayishi, Masayoshi** Unirational quasi-elliptic surfaces in characteristic 3. (55 #10471)  
**Platonov, V. P.** Birational properties of the reduced Whitehead group. (Russian) (55 #5590)  
**van Praag, Paul** Sur les sous-corps des corps de Weyl qui sont les corps des fonctions rationnelles sur une courbe algébrique. (English summary) (55 #5643)  
**Russell, Peter** Simple birational extensions of two dimensional affine rational domains. 55 #2943  
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**Sansuc, Jean-Jacques** *See* **Colliot-Thélène, Jean-Louis**, (56 #5561) and **Colliot-Thélène, Jean-Louis**, (56 #5565)  
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#### 14M99 None of the above, but in this section

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**Freedman, Michael H.** Surgery on codimension 2 submanifolds. (56 #13231)  
**Renschuch, Bodo** Zur Klassifizierung Veronesescher Projektionsideale. 55 #363  
**Schiemann, Günther** Zwei Klassen algebraischer Varietäten 3. Ordnung und deren Homologiegruppen. 56 #5585

### 14Nxx Classical methods and problems

#### 14N05 Projective techniques

**Krames, Josef** Über kubische Zykliken. (55 #5644)  
**Krys, Jaromir** Point configurations of a plane cubic. III. (Czech. German and loose Russian summaries) 56 #5586  
**Mandan, Sahib Ram** Geometry of a tetrahedron inscribed in a twisted cubic. 55 #5651  
**Muleškov, A. S.** *See* **Popov, E. S.**, 55 #2944  
**Popov, E. S.** (*with* Muleškov, A. S.) A certain projective property of curves of degree two. (Bulgarian. Russian and English summaries) 55 #2944  
**Renschuch, Bodo** Zur Klassifizierung Veronesescher Projektionsideale. (55 #363)  
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**Tefova, E. L.** Analytic calculation of the coordinates of lines under a skew mapping in  $P_4$ . (Russian) en55 #2945  
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#### 14N10 Enumerative problems

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*r*-special subschemes and an argument of Severi's. (55 #8033)  
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**Matuatat, Elisabeth** *See* **Renschuch, Bodo**, (56 #3009)  
**Papantonopoulou, Aigli** Curves in Grassmann varieties. (55 #10475)  
**Renschuch, Bodo** (*with* Matuatat, Elisabeth) Beiträge zur konstruktiven Theorie der Polynomideale. IV. Zur Berechnung von äquivalenten  $H$ -Idealen und Minimalbasen für inhomogene  $P$ -Ideale. (Russian and English summaries) (56 #3009)  
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**Whiteley, Walter** Logic and invariant theory. I. Invariant theory of projective properties. (56 #5279)  
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#### 14N99 None of the above, but in this section

### 15-XX LINEAR AND MULTILINEAR ALGEBRA; MATRIX THEORY (finite and infinite)

#### 15-01 Elementary exposition (collegiate level)

**Barreto G., José A.** Applications of linear algebra. (Spanish) 55 #10476  
**Białynicki-Birula, Andrzej** ★Algebra liniowa z geometrią. (Polish) [Linear algebra with geometry] [Mathematics Library, Vol. 48] 55 #2947  
**Brickell, F.** ★Matrices and vector spaces. 56 #378  
 ★Matrizen und Vektorräume. 56 #379  
**Brisley, Warren** ★Grundbegriffe der linearen Algebra. 55 #5653  
**Efimov, N. V.** ★Formes quadratiques et matrices. 55 #8057  
**Heinhold, Josef** (*with* Riedmüller, Bruno) ★Lineare Algebra und analytische Geometrie. Teil 1. 56 #15665  
 (Horn, Andreas) *See* **Brickell, F.**, 56 #379  
**Jaeger, Arno** (*with* Wenke, Klaus) ★Lineare Wirtschafts algebra. 55 #12744  
**Joshi, A. W.** ★Matrices and tensors in physics. 55 #10477  
**Kowalczyk, Bohdan** ★Macierze i ich zastosowania. (Polish) [Matrices and their applications] 56 #8589  
**Kuhnert, Frieder** ★Vorlesungen über lineare Algebra. 55 #2948  
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**Riedmüller, Bruno** *See* **Heinhold, Josef**, 56 #15665  
**Šilov, G. E.** An introduction to the theory of linear spaces. 55 #8058  
 (Silverman, Richard A.) *See* **Šilov, G. E.**, 55 #8058  
**Smirnov, V. I.** ★Lehrgang der höheren Mathematik. Teil III, 1. (55 #12381)  
 (Taschner, Rudolf J.) *See* **Brisley, Warren**, 55 #5653  
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**Voevodin, V. V.** ★Algèbre linéaire. 55 #8059  
**Wenke, Klaus** *See* **Jaeger, Arno**, 55 #12744

#### 15-02 Advanced exposition (research surveys, etc.)

**Plemmons, R. J.**  $M$ -matrix characterizations. I. Nonsingular  $M$ -matrices. 56 #3031  
**Pullman, N. J.** ★Matrix theory and its applications. 55 #2949

#### 15-03 Historical

**Schneider, Hans** The concepts of irreducibility and full indecomposability of a matrix in the works of Frobenius, König and Markov. (56 #5170)

#### 15-04 Explicit machine computation and programs (not the theory of computation or programming)

**Heller, D. E.** (*with* Stevenson, D. K.; Traub, J. F.) Accelerated iterative methods for the solution of tridiagonal systems on parallel computers. (55 #6809)



Stevenson, D. K. See Heller, D. E.; et al., (55 #6809)  
 Traub, J. F. See Heller, D. E.; et al., (55 #6809)

## 15-06 Collections of papers; proceedings of conferences

### 15A03 Vector spaces, linear dependence, rank

Aoki, Masanao On subspaces associated with partial reconstruction of state vectors, the structure algorithm, and the predicatable directions of Riccati equations. (56 #11187)  
 Bahadur, Lal Vector space over an infinite field. 56 #12021  
 Connell, I. An estimate for the dimension of the product of two vector spaces. 55 #5654  
 Cummings, Larry J. (with Robinson, Robert W.) Linear symmetry classes. 55 #2950  
 Farjot, Paulette Rang des matrices hermitiennes semi-définies positives indéfiniment divisibles. (English summary) 56 #15666  
 Grigor'ev, D. Ju. The algebraic complexity of computing a pair of bilinear forms. (Russian. English summary) 56 #12022  
 Khasbardar, Sunanda K. (with Thakare, Nimbakrishna) On vectorial paranorms. 56 #8590  
 Kierat, Wl. On linear transformations with infinite ascent. 56 #5588  
 Krzywiec, Robert Multi-index sequences. (Polish. Russian and English summaries) 56 #15667  
 Kuczma, Marek On mappings preserving linear dependence and independence. (Polish summary) (55 #913)  
 Robinson, Robert W. See Cummings, Larry J., 55 #2950  
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### 15A06 Linear equations

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 Shivakumar, P. N. (with Chew, Kim Ho) Iterations for diagonally dominant matrices. (55 #9506)

### 15A09 Matrix inversion, generalized inverses

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 Csáki, F. G. Some notes on the inversion of confluent Vandermonde matrices. (55 #11583)  
 Hall, Frank J. (with Meyer, Carl D., Jr.) Generalized inverses of the fundamental bordered matrix used in linear estimation. 55 #10478  
 On the independence of blocks of generalized inverses of bordered matrices. 56 #8591  
 Hartwig, Robert E. (with Katz, Irving J.) Products of EP elements in reflexive semi-groups. (56 #8729)  
 Hild, Claus A note on some matrices used in linear regression models. (56 #9833)  
 Jusupov, A. K. Inversion of a random matrix. (Russian) (56 #1394)  
 Katz, Irving J. See Hartwig, Robert E., (56 #8729)  
 Knöpp, Ulrich Über die Inversion gewisser unendlicher Matrizen. 56 #8592  
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 Mitra, Sujit Kumar (with Rao, C. Radhakrishna) Extensions of a duality theorem concerning  $g$ -inverses of matrices. 56 #3033  
 Murphy, Brian B. On the inverses of  $M$ -matrices. 55 #2952  
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 Strintzis, Michael G. Diagonalization, rank calculation and generalized inverses of rational matrices. (55 #5660)  
 Valvi, F. Explicit presentation of the inverses of some types of matrices. 55 #12745

### 15A12 Conditioning of matrices [See also 65F35.]

Faddeev, D. K. A matrix algebra and its applications to numerical problems. (Russian) (55 #4642)  
 Golub, Gene H. (with Varah, J. M.) On a characterization of the best  $l_2$ -scaling of a matrix. (55 #9510)  
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 Wrobel, Bernhard Zur Steigerung der Auflösungs-genauigkeit von Normalgleichungen durch Konditionsverbesserung mittels additiver Modifikation. (56 #4142)

### 15A15 Determinants, permanents, other special matrix functions

Balasubramanian, K. Determinant and permanent with respect to group complexes. 56 #591  
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- Wadsworth, Adrian R. (with Shapiro, Daniel B.) Spaces of similarities. III. Function fields. **(56** #11898c)
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- Waterhouse, William C. Pairs of quadratic forms. **(55** #265)
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- 15A66 Clifford algebras**
- Benenti, Sergio Su di una particolare classe di rotazioni negli spazi quadridimensionali non minkowskiani. (English summary) **(55** #7919)
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- Revoy, Philippe Nouvelles algèbres de Clifford. (English summary) **55** #8073
- 15A69 Multilinear algebra, tensor products**
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- Dearden, Bruce See McKennon, K., **55** #10490
- Kruskal, Joseph B. Three-way arrays: rank and uniqueness of trilinear decompositions, with application to arithmetic complexity and statistics. **56** #3040
- Lim, Ming Huat Regular symmetry classes of tensors. **55** #2965
- Rank  $k$  vectors in symmetry classes of tensors. **55** #5670
- A uniqueness theorem in symmetry classes. **55** #2966
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- Stone, Alexander P. A multilinear algebra proof of the Cayley-Hamilton theorem. **55** #382



## 15A72 Vector and tensor algebra, theory of invariants

- Ament, W. S. ★Finite arithmetics applying to certain geometric algebras. **55** #2968
- Benenti, Sergio Sulla rappresentazione tramite tensori emisimmetrici di operatori ortogonali in uno spazio tridimensionale. (French summary) **56** #5614
- Brodskii, I. B. The invariants of unipotent groups. (Russian) **(55)** #5757
- Dobkin, David On the optimal evaluation of a set of  $n$ -linear forms. **(55)** #11703
- Green, Edward L. Complete intersections in tensor algebras. I. **55** #8074  
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- Hipps, N. (with Mount, Kenneth R.; Villamayor, O. E.) Sur la polarisation des polynômes homogènes en caractéristique  $p > 0$ . (English summary) **(55)** #12723
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- Roganov, Ju. V. Heredity of the tensor algebra and the semi-heredity of the complemented tensor algebra. (Russian. English summary) **56** #5615
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- Springer, T. A. ★Invariant theory. **(56)** #5740
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- Vust, Th. Sur la théorie classique des invariants. **56** #15683
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- (Young, Alfred) See Robinson, Gilbert de B., **(55)** #10208
- Bibliography:**  
Young, Alfred See Robinson, Gilbert de B., **(55)** #10208

## 15A75 Exterior algebra, Grassmann algebras

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- Marcus, Marvin (with Robinson, Herbert) On exterior powers of endomorphisms. **56** #5616
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- Westwick, R. Linear transformations on Grassmann spaces. III. **55** #2969

## 15A78 Other algebras built from modules

- Bass, Hyman (with Connell, E. H.; Wright, D. L.) Locally polynomial algebras are symmetric algebras. **(55)** #5613
- Connell, E. H. See Bass, Hyman; et al., **(55)** #5613
- Orzech, Morris Brauer groups of graded algebras. **(56)** #8545
- Suslin, A. A. Locally polynomial rings and symmetric algebras. (Russian) **(56)** #2997
- Wright, D. L. See Bass, Hyman; et al., **(55)** #5613

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## 16–XX ASSOCIATIVE RINGS AND ALGEBRAS [For the commutative case, see 13–XX.]

- (Borevič, Z. I.) See Modules and representations, **(56)** #11977
- (Skopin, A. I.) See Modules and representations, **(56)** #11977
- Modules and representations ★Модули и представления. (Russian) [Modules and representations] **(56)** #11977
- Representations See Modules and representations, **(56)** #11977

## 16–01 Elementary exposition (collegiate level)

- Larguier, Everett ★Comparing forests. **56** #394
- Szász, Ferenc ★Radikale der Ringe. **(55)** #8086
- Bibliography:**  
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## 16–02 Advanced exposition (research surveys, etc.)

- Faith, Carl ★Algebra. II. **55** #383
- Goodearl, K. R. ★Ring theory. **55** #2970
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- (Koifman, L. A.) See Skornjakov, L. A.; et al., **56** #395
- Mal'cev, Ju. N. Selected questions in the theory of associative rings. (Russian) **55** #10494
- (Markov, V. T.) See Skornjakov, L. A.; et al., **56** #395
- Mihalev, A. V. (with Skornjakov, L. A.) Books, and various questions. (Russian) **56** #5617  
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- Schacher, Murray The crossed-product problem. **(55)** #8100
- Skornjakov, L. A. (with Mihalev, A. V.) Modules. (Russian. Errata insert; loose summary) **56** #395  
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## 16–03 Historical

## 16–04 Explicit machine computation and programs (not the theory of computation or programming)

- Ževlakov, V. A. An algorithm for the proof of algebraic identities by means of an electronic computer. (Russian) **56** #15684

## 16–06 Collections of papers; proceedings of conferences

- Andrunakievič, V. A. (with Rjabuhin, Ju. M.) The additive theory of ideals of rings. (Russian) **55** #10493  
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- (Bokut', L. A.) See Rings, **55** #10492
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- (McDonald, B. R.) See Ring theory, **55** #2974
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- (Morris, Robert A.) See Ring theory, **55** #2974
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- Brungs, H. H. See Mura, Roberta; et al., **(56)** #8615
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- Fried, E. See Sichler, J., **(55)** #3023
- Mura, Roberta (with Brungs, H. H.; Fisher, James L.) Chain rings and valuation semigroups. **(56)** #8615
- Rjabuhin, Ju. M. See Andrunakievič, V. A., **(55)** #10493
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- Sichler, J. (with Fried, E.) Integral domains form a universal category. **(55)** #3023

## 16A04 Noncommutative principal ideal rings, rings with a division algorithm

- Achkar, Habib Sur les propriétés des anneaux arithmétiques à gauche. (English summary) **(55)** #5671
- Cohn, P. M. A construction of simple principal right ideal domains. **(56)** #12058
- Fisher, James L. Finite principal ideal rings. **(55)** #2988
- Gorbačuk, O. L. (with Komarnic'kii, M. Ja.) Radical filters in a principal ideal domain. (Russian. English summary) **56** #12044
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- Vidal, Robert Anneaux principaux, non nécessairement commutatifs, séparés et complets pour la topologie de Krull. (English summary) **55** #384

## 16A06 Free algebras, free ideal rings (firs) and their generalizations [See also tensor algebra in 15A72.]

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- Laffey, Thomas J. Square zero subalgebras of algebras. **55** #8078
- Lamèche-Gérardin, Khyra Quotient d'Hadamard de séries rationnelles à plusieurs variables non commutatives. **56** #12045
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- de produits tensoriels d'algèbres. (English summary) **56** #396  
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- Beachy, John A. Some aspects of noncommutative localization. **55** #2976  
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- Castillon, Jean-Bernard Sur une classe d'anneaux locaux non commutatifs. **55** #388  
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## 16A12 Prime and semiprime rings

- Goel, V. K. (with Jain, S. K.; Singh, Surjeet) Semiprime rings with finite length w.r.t. an idempotent kernel functor. **56** #8603  
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- Borevič, A. Z. The Brauer imbedding problem for commutative rings. (Russian) (**56** #11978)  
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## 16A20 Primitive and semiprimitive rings

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## 16A21 Radical theory

- Andrunakievič, A. V. Prime modules, prime one-sided ideals, and the Baer radical. (Russian) **55** #2979  
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## 16A24 Hopf algebras, algebraic theory [See also 57F05.]

- Filser, Georg A note on the antipode of free Hopf algebras. **56** #5627  
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- Radford, David E.** Commutative nearly primitively generated Hopf algebras. 55 #394  
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- Paramhans, S. A. *See* Tiwary, A. K., **55** #12771 and Tiwary, A. K., **56** #15702
- Radnev, P. Injective objects in the category of  $p$ -rings. (Russian. English summary) **55** #2999
- Singh, Surjeet *See* Mohamed, Saad, **56** #415
- Tisseron, C. Sur les anneaux tels que tout produit de copies d'un module quasi-injectif soit un module quasi injectif. II. **55** #8104
- Tiwary, A. K. (with Paramhans, S. A.) On injective cogenerators. **55** #12771  
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- 16A54** Grothendieck groups of rings,  $K$ -theory of noncommutative rings [See also 18F25.]
- Anderson, D. (with Karoubi, M.; Wagoner, J. B.) Higher algebraic  $K$ -theories. (**56** #3092)
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- Karoubi, M. *See* Anderson, D.; et al., (**56** #3092)
- Keating, M. E.  $G_1$  of an integral group ring. **55** #10525
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- 16A56** Extension theory
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- Goldie, A. W. Ore extensions and polycyclic group rings. **55** #8105
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- Kanzaki, Teruo Note on quaternion algebras over a commutative ring. **55** #3000
- Kishimoto, Kazuo A classification of free extensions of rings of automorphism type and derivation type. (**56** #12072)
- Nagahara, Takasi On separable polynomials of degree 2 in skew polynomial rings. **56** #12065  
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- 16A58** Deformation theory of rings and algebras [See also 13D10, 32Gxx.]
- 16A60** Homological dimension
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- Willson, Stephen J. Homological dimensions of the isotropy ring. **55** #3002
- 16A62** Homological methods [For cohomology of algebras and rings, see 18H15.]
- Bernecker, Harro Flatness and absolute purity applying functor categories to ring theory. (**55** #5691)
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- Nishida, Kenji Remarks on relatively flat modules. (**56** #3056)
- Onodera, Takeshi Codominant dimensions and Morita equivalences. **56** #8626
- van Oystaeyen, F. Stalks of sheaves over the spectra of certain noncommutative rings. Addendum: "Sheaves over the spectra of certain noncommutative rings" (Comm.



- Algebra **4** (1976), no. 5, 491–502) by J. S. Golan, J. Raynaud and the author. **55** #12772
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- Paugam, Michel** Sur les invariants homologiques des anneaux locaux noethériens: un calcul de la cinquième déflexion  $e_5$ . (English summary) (55 #5611)
- (Raynaud, Jacques) See van Oystaeyen, F., **55** #12772
- de Robert, Étienne Suites exactes absolument scindées. (English summary) **56** #419
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- Scott, Leonard L.** Permutation modules and 1-cohomology (56 #5689)
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- Auslander, Maurice** Existence theorems for almost split sequences. (55 #12764)
- (with Reiten, Idun) Representation theory of Artin algebras. IV. Invariants given by almost split sequences. (55 #12762)
- (with Reiten, Idun) Representation theory of Artin algebras. V. Methods for computing almost split sequences and irreducible morphisms. (55 #12763)
- Bican, Ladislav** (with Jambor, Pavel; Kepka, Tomáš; Némec, Petr) Generation of pre-radicals. (55 #8141)
- Borevič, Z. I.** (with Devjatko, G. I.) Invariant forms on modules with operators. (Russian) (56 #11900)
- Brenner, Sheila** (with Butler, M. C. R.) The equivalence of certain functors occurring in the representation theory of Artin algebras and species. **56** #420
- (with Ringel, Claus Michael) Pathological modules over tame rings. **55** #5697
- (Buiculescu, Mioara) See Solian, Alexandru, **56** #5659
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- Devjatko, G. I.** See Borevič, Z. I., (56 #11900)
- Dlab, Vlastimil** (with Ringel, Claus Michael) Indecomposable representations of graphs and algebras. **56** #5657
- Elliger, Sigurd** On the bimodule structure of Galois extensions. **55** #10528
- Feinberg, Robert B.** Faithful distributive modules over incidence algebras. **55** #413
- Fuchs, László** Cotorsion modules over Noetherian hereditary rings. **55** #414
- Gabriel, Peter** Représentations indécomposables des ensembles ordonnés. (55 #12581)
- Gilmer, Robert** Modules that are finite sums of simple submodules. **56** #8628
- Goldman, Oscar** Elements of noncommutative arithmetic. I. **55** #3003
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- Gordon, Robert** (with Green, Edward L.) Indecomposable modules: amalgamations. **55** #5699
- (with Green, Edward L.) Modules with cores and amalgamations of indecomposable modules. **56** #12068
- Green, Edward L.** Diagrammatic techniques in the study of indecomposable modules. **56** #12069
- A note on modules with waists. **55** #5700
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- Kleiner, M. M.** See Roiter, A. V., **55** #8106
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- Mewborn, A. C.** See Goldston Barnwell, Beth, **56** #8629
- Mogami, Isao** (with Tominaga, Hisao) On coprimary decomposition theory for modules. **56** #421
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- Pastijn, Francis** Orthodox bands of modules. **56** #3061
- Plahotnik, V. V.** Representations of partially ordered sets over commutative rings. (Russian) **56** #5658
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- Tominaga, Hisao** See Mogami, Isao, **56** #421
- Trushin, David** A theorem on induced corepresentations and applications to finite group theory. **55** #5701
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- Zavadskii, A. G.** (with Kiričenko, V. V.) Semimaximal rings of finite type. (Russian) **56** #15706

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- Fromagot, Robert** Décomposition des idéaux semi-premiers d'un anneau unitaire et des idéaux bilatères d'un anneau absolument plat. **55** #8109
- Hansen, Friedhelm** Schranken für die Gabriel- und Krull-Dimension Idealisator-ähnlicher Ringweiterungen. (56 #12060)
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- Rao, Salvatore** Alcune questioni di risolubilità in anelli associativi. (English summary) **56** #8634
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- Benkart, Georgia** The Lie inner ideal structure of associative rings. **55** #8110
- Martindale, Wallace S., III** Lie and Jordan mappings in associative rings. **56** #5660
- Vidal, Robert** Un exemple d'anneau de valuation discrète complet, non commutatif qui n'est pas un anneau de Cohen. (English summary) **55** #12773

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- Blair, Robert L.** On the commutativity of certain topological rings. (55 #8116)
- Harmanci, A.** Two elementary commutativity theorems for rings. **56** #3062
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- Ligh, Steve** (with Richoux, Anthony) A commutativity theorem for rings. **55** #8111
- Richoux, Anthony** See Ligh, Steve, **55** #8111
- Streh, W.** Gesetze in Ringen hinreichend für ihre Kommutativität. **55** #12774
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- Beidar, K. I.** The ring of invariants under the action of a finite group of automorphisms of a ring. (Russian) **56** #3063
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- Elliger, Sigurd** Über Automorphismen und Derivationen von Ringen. **55** #418
- Fisher, Joe W.** (with Osterburg, James) Some results on rings with finite group actions. (56 #411)
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- Osterburg, James** See Fisher, Joe W., (56 #411)
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- Über die Struktur galoisscher Erweiterungen einfacher Ringe. **55** #8112
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- Roark, Charles Winfred** Separable criteria for  $G$ -diagrams over commutative rings. **55** #10533
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- Chao, D. Z.** Near-ring without non-zero nilpotent elements. **55** #5703
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- Free distributively generated algebras over a set. (Dutch summary) **55** #5704
- Kaarli, K.** Minimal ideals in near-rings. (Russian. Estonian and English summaries) **56** #424



- Ligh, Steve** (*with* Utumi, Yuzo) Some generalizations of strongly regular near rings. **55** #8113
- Malone, J. J.** More on groups in which each element commutes with its endomorphic images. **56** #5664
- Meldrum, John D. P.** Injective near-ring modules over  $Z_n$ . **56** #15707
- Natarajan, N. S.** Semisimple  $N$ -groups. **56** #12073
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- Szeto, George** The sheaf representation of near-rings and its applications. **55** #10534
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- Utumi, Yuzo** See **Ligh, Steve**, **55** #8113
- Wahling, Heinz** Ein Zassenhauskriterium für unendliche Fastkörper. (**55** #12712)

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- Bathedat, André** Préalgèbres contenant un idempotent associatif. (Italian summary) **56** #5665
- Dale, Louis** (*with* Hanson, Dorothy L.) The structure of idelas in a Euclidean semiring. **56** #3066
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- Hestenes, Magnus R.** On a ternary algebra. (**56** #3174)
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- Klipker, I. A.** An abstract characteristic of the semiring of binary relations on a finite set. (Russian. Georgian summary) **55** #10535
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- Polin, S. V.** Generalizations of rings. (Russian) **55** #8114
- Poyatos Suárez, Francisco** On certain properties of the bi-ideals of a semiring. (Spanish) **56** #15708
- Weinert, Hanns Joachim** Related representation theorems for rings, semirings, near-rings and semi-near-rings by partial transformations and partial endomorphisms. **56** #8637
- (*with* Griepentrog, R. D.) Embedding semirings by translational hulls. **56** #5666
- Rings** See **Polin, S. V.**, **55** #8114

## 16A80 Topological rings and semirings [For ordered rings, see 06A70; see also 13Jxx.]

- Antonovskii, M. Ja.** (*with* Boltjanskii, V. G.) Tihonov semifields and certain problems of general topology. (Russian) **56** #8638a
- (*with* Choodnovsky, David V.) Certain questions of general topology, and Tihonov semifields. II. (Russian) **56** #8638b
- Arizmendi Peimbert, Hugo** Distinct topologies whose locally determined ideals coincide with the closed ideals. (Spanish) **56** #15709
- Arnautov, V. I.** (*with* Vodinčar, M. I.) Topological rings. (Russian) **55** #8115
- Blair, Robert L.** On the commutativity of certain topological rings. **55** #8116
- Boltjanskii, V. G.** See **Antonovskii, M. Ja.**, **56** #8638a
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- Dikranjan, Dikran** Minimal precompact topologies in rings. (Russian summary) **55** #420
- Precompact minimal topologies on Noetherian domains. **55** #421
- Mihalev, A. V.** Topological and ordered modules. (Russian) **56** #5667
- Nasirov, S. N.** A class of rings and their continuous homomorphisms. (Russian) **56** #426
- Prodanov, Ivan** Minimal compact representations of algebras. (Russian summary) **55** #422
- Stout, Lawrence Neff** A topological structure on the structure sheaf of a topological ring. **56** #3068
- Swan, Richard G.** Topological examples of projective modules. (**56** #6657)
- Vizitiu, V. N.** Topological rings with an m-unrefinable topology. (Russian) **55** #12776
- Vodinčar, M. I.** See **Arnautov, V. I.**, **55** #8115
- Warner, Seth** Topological rings that generalize Artinian rings. **56** #5668
- Widiger, Alfred** Zur Zerlegung im engeren Sinne linear kompakter Ringe. **56** #5669
- Rings** See **Arnautov, V. I.**; et al., **55** #8115

## 17-XX NONASSOCIATIVE RINGS AND ALGEBRAS

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### 17-02 Advanced exposition (research surveys, etc.)

- Lepowsky, J.** (*with* McCollum, G. W.) ★Elementary Lie algebra theory. **55** #423
- McCollum, G. W.** See **Lepowsky, J.**, **55** #423

### 17-03 Historical

### 17-04 Explicit machine computation and programs (not the theory of computation or programming)

- Conatser, C. W.** (*with* Huddleston, P. L.) Computation of Casimir invariants of Lie algebras. **56** #8639
- Huddleston, P. L.** See **Conatser, C. W.**, **56** #8639
- McKay, W.** (*with* Patera, Jiri; Sankoff, David) The computation of branching rules for representations of semisimple Lie algebras. **56** #15710

- Patera, Jiri** See **McKay, W.**; et al., **56** #15710
- Sankoff, David** See **McKay, W.**; et al., **56** #15710
- Smith, B. T.** (*with* Wos, L. T.) An unnatural attack on the structure problem for the free Jordan ring on 3 letters: an application of quad arithmetic. **56** #15711
- Wos, L. T.** See **Smith, B. T.**, **56** #15711

### 17-06 Collections of papers; proceedings of conferences

- (Beck, Robert E.) See **Computers in nonassociative rings and algebras**, **56** #427
- (Bokut', L. A.) See **Rings**, **55** #8117
- (Kolman, Bernard) See **Computers in nonassociative rings and algebras**, **56** #427
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- Algebra** See **Computers in nonassociative rings and algebras**, **56** #427
- Computers in nonassociative rings and algebras** ★Computers in nonassociative rings and algebras. **56** #427
- Meeting:**
- American Mathematical Society, 82nd Annual (San Antonio, Tex., 1976) See **Computers in nonassociative rings and algebras**, **56** #427
- Rings** See **Computers in nonassociative rings and algebras**, **56** #427
- Rings** ★Кольца. I. (Russian) [Rings. I] **55** #8117

## 17Axx General nonassociative algebras

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- Testov, V. A.** Monoassociative division algebras. (Russian) **56** #8640

### 17A10 Commutative power-associative

### 17A15 Noncommutative Jordan algebras

- Britten, Daniel J.** On prime Goldie-like quadratic Jordan matrix algebras. **56** #12075
- Gordon, S. Robert** On the structure group of a split semisimple Jordan algebra. I. **56** #428a
- On the structure group of a split semisimple Jordan algebra. II. **56** #428b
- Loustau, J. A.** The structure of algebraic Jordan algebras without nonzero nilpotent elements. **56** #429
- Šestakov, I. P.** Noncommutative Jordan and right-alternative rings. (Russian) **55** #8118
- Rings** See **Šestakov, I. P.**, **55** #8118

### 17A20 Flexible algebras

- Ljubić, Ju. I.** Nilpotency of commutative Engel algebras of dimension  $n < 4$  over  $R$ . (Russian) **55** #12778

### 17A25 Nodal algebras

### 17A30 Algebras satisfying other identities

- Dorofeev, G. V.** The join of varieties of algebras. (Russian) **55** #12777
- Identities of generalized accessible rings. (Russian) **56** #3069
- Gainov, A. T.** Rings that are "far" from associative. (Russian) **55** #8119
- Hentzel, Irvin Roy** Applying group representation to nonassociative algebras. **55** #8120
- (*with* Piacentini Cattaneo, Giulia Maria) Simple  $(\gamma, \delta)$  algebras are associative. **56** #430
- Lex, Wilfried** Linksquasialternative reelle Divisionsalgebren endlichen Ranges. **56** #3070
- Long, F. W.** Corrections to Dickson's table of three dimensional division algebras over  $F_5$ . **56** #431
- Pčelincev, S. V.** Nilpotency of the associator ideal of a free finitely generated  $(-1, 1)$ -ring. (Russian) **55** #424
- Piacentini Cattaneo, Giulia Maria** See **Hentzel, Irvin Roy**, **56** #430
- Pokrass, David J.** (*with* Rodabaugh, D. J.) On the nilpotency of generalized alternative algebras. **56** #15712
- Polin, S. V.** Identities of finite algebras. (Russian) (**55** #12601)
- Rodabaugh, D. J.** See **Pokrass, David J.**, **56** #15712
- Roomeldi, R.** Centers of free  $(-1, 1)$ -ring. (Russian) **56** #15713
- Stitzinger, Ernest L.** Two notes on nilpotency and standard algebras. **55** #8121
- Urman, A. A.** The varieties of algebras with commutative product of subvarieties. II. (Russian) **55** #12779
- Rings** See **Gainov, A. T.**, **55** #8119

### 17A99 None of the above, but in this section

- Boers, A. H.** (*with* Ilamed, Y. L.) Chains of subrings and ideals in non-associative rings. **55** #8122
- Bunder, M. W.** Commutative non-associative number theory. (**55** #301)
- Czerwinski, R. A.** Bonded quadratic division algebras. **55** #8123
- Delkin, J. S.** On noncommutative polynomial rings with a weakly nilpotent derivation. (**55** #3005)
- Dorfmeister, J.** (*with* Koecher, Max) Relative Invarianten und nicht-assoziative Algebren. (**56** #438)
- Dorofeev, G. V.** (*with* Pčelincev, S. V.) Varieties of standard and accessible algebras. (Russian) **56** #8641
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17B40 Automorphisms, derivations, other operators

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17B45 Lie algebras of linear algebraic groups [See also 14Lxx and 20Gxx.]

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17B60 Lie rings associated with other structures (associative, Jordan, etc.) [See also 15A30, 16A68, 17C40, 17C50.]

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17C10 Structure theory

**Baxter, W. E.** (*with* Casciotti, L. A.) Rings with involution and the prime radical. (**55** #8089)  
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17C15 Representations

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17C30 Automorphisms, derivations, other operators

17C35 Formally real domains of positivity [See also 32Nxx.]

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17C40 Exceptional Jordan algebras and associated Lie groups

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17C45 Homological methods in Jordan algebras [For homology of Jordan algebras, see 18H30.]

17C50 Jordan rings associated with other structures [See also 16A68, 17B60.]

**Slin'ko, A. M.** Jordan rings. (Russian) **55** #8133  
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**Koecher, Max** Jordan algebras and differential geometry. **55** #3021

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**Dorofeev, G. V.** Alternative and right-alternative rings. (Russian) **55** #8134  
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**Šestakov, I. P.** Radicals and nilpotent elements of free alternative algebras. (Russian) **55** #447  
**Thedy, Armin** Nil-semisimple right alternative algebras. **56** #15722  
**Rings** *See* **Dorofeev, G. V.**, **55** #8134

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**Enescu, I.** On a class of nonassociative algebras. (Romanian. French summary) **56** #15723  
**Floyd, D. R.** *See* **Hentzel, Irvin Roy**; et al., **56** #5674  
**Hein, W.** A connection between Lie algebras of type  $F_4$  and Cayley algebras. **55** #448  
**Hentzel, Irvin Roy** (*with* Piacentini Cattaneo, Giulia Maria; Floyd, D. R.) Alternator and associator ideal algebras. **56** #5674  
**Piacentini Cattaneo, Giulia Maria** *See* **Hentzel, Irvin Roy**; et al., **56** #5674  
**Rabsztyn, Szymon** On the finite dimensional representations of the pseudo-Lie algebras. (**56** #7523)  
**Wisbauer, Robert** Co-semisimple modules and nonassociative  $V$ -rings. **56** #5675  
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18—XX CATEGORY THEORY, HOMOLOGICAL ALGEBRA

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**Junek, Heinz** Über Hüllenoperationen, Reflektoren und Ideale. (Russian and English summaries) **56** #3080  
**Weller, H.** *See* **Artmann, Benno**, **56** #15725  
**Wiweger, A.** Difficulties with the empty set. (Polish) (**56** #11798)



- 18-02 Advanced exposition (research surveys, etc.)
- Calenko, M. Š. (with Šul'geifer, E. G.) Categories. (Russian) **56** #3081  
 Šul'geifer, E. G. See Calenko, M. Š., **56** #3081
- 18-03 Historical
- 18-04 Explicit machine computation and programs (not the theory of computation or programming)
- 18-06 Collections of papers; proceedings of conferences
- 18Axx General theory of categories and functors**
- 18A05 Definitions, generalizations
- 18A10 Graphs, groupoids, neofunctors [See also 20Lxx.]
- 18A15 Foundations, relations to logic and deductive systems [See also 02-XX.]
- Blanc, Georges (with Preller, Anne) Lawvere's basic theory of the category of categories. (55 #2554)
- Marchini, Carlo Alcune questioni di semantica in un topos elementare. (English summary) (56 #80)
- Mikkelsen, Christian Juul ★Lattice theoretic and logical aspects of elementary topoi. (55 #2572)
- Osius, Gerhard Eine Erweiterung der NGB-Mengenlehre als Grundlage der Kategorientheorie. (English summary) (55 #2573)
- Piaget, J. Structures et catégories. (56 #5200)
- Preller, Anne See Blanc, Georges, (55 #2554)
- Schlomiuk, Dana I. ★Logique des topos (introduction à la théorie des topos élémentaires). n(56 #11790)
- 18A20 Epimorphisms, monomorphisms, special classes of morphisms, null morphisms, factorization (bicategories)
- Batbedat, André Les foncteurs Idé. (English summary) **55** #10537
- Hoffmann, Rudolf-E. Topological functors and factorizations. (55 #1280)  
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- Kopeček, Ivan See Veselý, Vitězslav, (56 #2882)
- Lamartin, W. F. Epics in the category of  $T_2$   $k$ -groups need not have dense range. (55 #556)
- Strecker, G. E. Perfect sources. (56 #9479)
- Veselý, Vitězslav (with Kopeček, Ivan) Monomorphisms in the categories of connected algebraic systems with strong homomorphisms. (56 #2882)
- 18A25 Functor categories, comma categories
- Bernecker, Harro Flatness and absolute purity applying functor categories to ring theory. (55 #5691)
- Fontet, Max Un résultat en théorie des groupes de permutations et son application au calcul effectif du groupe d'automorphismes d'un automate fini. (English summary) (55 #5725)
- Pellegrino, Consolato Creazione di limiti nelle categorie comma. (English summary) **55** #8135
- 18A30 Limits and colimits (products, sums, pushouts, fiber products, equalizers, kernels, ends and coends, etc.)
- Bozapalides, Syméon Sur les quasi-limites. **55** #5711
- Conduche, François Sur les structures définies par limites projectives. **55** #5712
- Hofmann, Karl Heinrich Category theoretical methods in topological algebra. (56 #15819)
- Otal Cincá, J. Classes of residually closed objects. (Spanish. English summary) **55** #12787  
 Residually closed classes of objects. (Spanish. English summary) **55** #449
- Sirot, Jean-Marie Les fins cartésiennes. **56** #439
- Wood, R. J. Free colimits. **56** #15726
- 18A35 Complete categories, completions
- Frei, Armin On completion and shape. **55** #12788
- Herrlich, Horst Initial completions. **55** #10538
- Rosický, Jiří One example concerning testing categories. **55** #5713
- 18A40 Adjoint functors (representable functors, universal constructions, reflexive subcategories, etc.), constructions of adjoints (Kan extensions, etc.)
- Börger, Reinhard (with Tholen, Walter) Abschwächungen des Adjunktionsbegriffs. (English summary) **55** #5714
- Day, B. J. An adjoint-functor theorem over topoi. **55** #450
- Frei, Armin On categorical shape theory. (55 #12792)
- Guitart, René Calcul des relations inverses. (55 #12789)
- Hardie, K. A. A co-equalizer construction for left adjoint. **55** #10539
- Junek, Heinz Über Hüllenoperationen, Reflektoren und Ideale. (Russian and English summaries) (56 #3080)
- MacDonald, John L. Natural factorizations and the Kan extension of cohomology theories. **55** #451
- Medvedev, M. Ja. Semiadjoint functors, and Kan extensions. (Russian) **55** #452
- Racher, G. Einige Formeln für Funktoren auf Kategorien von Banachräumen. (55 #8828)
- Salbany, Sergio Lifting functors defined on separated subcategories. **55** #453
- Tholen, Walter See Börger, Reinhard, **55** #5714
- 18A99 None of the above, but in this section
- Brümmer, G. C. L. Topological functors and structure functors. **56** #440  
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- Dyckhoff, Roy Categorical methods in dimension theory. (56 #6625)
- Herrlich, Horst Regular categories and regular functors. **55** #5715
- Hoffmann, Rudolf-E. See Brümmer, G. C. L., **56** #441
- Hofmann, Karl Heinrich (with Mislove, Michael W.) Amalgamation in categories with concrete duals. **56** #5676
- Mislove, Michael W. See Hofmann, Karl Heinrich, **56** #5676
- Paré, Robert Colimits in topoi. **56** #442
- Šedivá-Trnková, Věra Productive representations of semigroups by pairs of structures. **56** #3082
- Vorster, S. J. R. Filters and uniformities in general categories. **56** #8652
- 18Bxx Special categories**
- 18B05 Category of sets, characterizations
- Blanc, Georges (with Donnadieu, Marie-Renée) Axiomatisation de la catégorie des catégories. (56 #15397)
- Blass, Andreas Two closed categories of filters. **56** #3083
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**Chen, Ming Ting** Cosimplicial cohomology and two term extensions of coalgebras. **56** #15735

**Nguyen Xuan Tuyen** Extensions of groups and monoids. (Russian. Georgian and English summaries) **55** #3038

Nonabelian extensions of monoids. (Russian. Georgian and English summaries) **55** #3039

The cohomology of monoids. (Russian. Georgian and English summaries) **56** #15736

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## 20–XX GROUP THEORY AND GENERALIZATIONS [For ordered groups, see 06A55.]

(Misjurkeev, I. V.) See *Group theory and certain questions of algebra*, **(55** #2429)

(Nagrebekii, V. T.) See *Algebraic studies*, **(55** #2423)

(Trofimov, P. I.) See *Group theory and certain questions of algebra*, **(55** #2429)

*Algebra* See *Group theory and certain questions of algebra*, **(55** #2429)

*Algebraic studies* ★Алгебраические исследования. (Russian) [*Algebraic studies*] **(55** #2423)

*Group theory and certain questions of algebra* ★Теория групп и некоторые вопросы алгебры. (Russian) [*Group theory and some questions of algebra*] **(55** #2429)

20–01 Elementary exposition (collegiate level)

**Artmann, Benno** Diedergruppen: Ein Beispiel für die Verwendung universeller Elemente. **56** #15737

(Józefiak, Tadeusz) See **Kargapolov, M. I.**; et al., **56** #3097

**Kargapolov, M. I.** (with Merzljakov, Ju. I.) ★Основы теории групп. (Russian) [*Fundamentals of group theory*] **56** #3096a

(with Merzljakov, Ju. I.) Podstawy teorii grup. (Polish) [*Fundamentals of group theory*] **56** #3097

(with Merzljakov, Ju. I.) ★Основы теории групп. (Russian) [*Fundamentals of group theory*] **56** #3096b

**Larguier, Everett** ★Comparing forests. **(56** #394)

**Merzljakov, Ju. I.** See **Kargapolov, M. I.**, **56** #3096a; **Kargapolov, M. I.**, **56** #3097 and **Kargapolov, M. I.**, **56** #3096b

**Nazzaro, Aristide** I gruppi e gli specchi sferici. **55** #5723

**Rosen, Joe** ★Symmetry discovered. **55** #12794

**Schwerdtfeger, Hans** ★Introduction to group theory. **55** #8151

**Weinstein, Michael** ★Examples of groups. **56** #12100

20–02 Advanced exposition (research surveys, etc.)

**Belonogov, V. A.** (with Fomin, A. N.) ★Матричные представления в теории конечных групп. (Russian) [*Matrix representations in the theory of finite groups*] **56** #5691

**Fomin, A. N.** See **Belonogov, V. A.**, **56** #5691

**Fuchs, László** ★Бесконечные абелевы группы. Том 2. (Russian) [*Infinite abelian groups*. Vol. 2] **56** #15738

(Kulikov, L. Ja.) See **Fuchs, László**, **56** #15738

(Manovcev, A. A.) See **Fuchs, László**, **56** #15738

(Mazurov, V. D.) See *Kourovka notebook: unsolved problems in the theory of groups*, **56** #5692

(Merzljakov, Ju. I.) See *Kourovka notebook: unsolved problems in the theory of groups*, **56** #5692

(Mišina, A. P.) See **Fuchs, László**, **56** #15738

**Orsatti, Adalberto** Alcuni aspetti della teoria dei gruppi abeliani. **55** #465

(Remeslennikov, V. N.) See *Kourovka notebook: unsolved problems in the theory of groups*, **56** #5692

**Rotman, Joseph J.** ★The theory of groups. An introduction. **56** #451

All-Union Symposium:

*Theory of Groups* See *Kourovka notebook: unsolved problems in the theory of groups*, **56** #5692

*Group theory* See *Kourovka notebook: unsolved problems in the theory of groups*, **56** #5692

*Kourovka notebook: unsolved problems in the theory of groups* ★Коуровская тетрадь: нерешенные задачи теории групп. (Russian) [*Kourovka notebook: unsolved problems in the theory of groups*] **56** #5692

**Krasnodar** See *Kourovka notebook: unsolved problems in the theory of groups*, **56** #5692

*Problems:*  
*Theory of groups* See *Kourovka notebook: unsolved problems in the theory of groups*, **56** #5692

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**Hawkins, Thomas** New light on Frobenius' creation of the theory of group characters. **(56** #5161)

20–04 Explicit machine computation and programs (not the theory of computation or programming)

(Belaga, È. G.) See *Computations in algebra and number theory*, **(56** #15248)

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**Božović, Ivan** See **Vujičić, Milan**; et al., **56** #15740

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**Geller, Eberhard** ★Ein Programm zur Bestimmung der Automorphismengruppen endlicher auflösbarer Gruppen. **55** #12795

**Gerhards, L.** On the construction of the automorphism group of a finite group. **55** #5724

**Herbut, Fedor** See **Vujičić, Milan**; et al., **56** #15740

**Meyers, Victor** (with Blockton, Connie) 1681 and all that. **55** #8152

**Newman, M. F.** Addendum: "A computer aided study of a group defined by fourth powers" (Bull. Austral. Math. Soc. **14** (1976), no. 2, 293–297). **55** #8153

**Vasil'ev, Ju. P.** (with Žerlov, A. K.) A description of finite nonsimple groups by means of an electronic computer. III. (Russian. English summary insert) **56** #15739

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## 20-06 Collections of papers; proceedings of conferences

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(Bryce, R. A.) See Group theory, 55 #3040

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## 20Axx Foundations

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### 20A10 Metamathematical considerations [For word problems, see 20F10.]

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Huber, Martin Sur le problème de Whitehead concernant les groupes abéliens libres. (English summary) (55 #98)

Kalman, J. A. Substitution-and-detachment systems related to abelian groups. (55 #5435)

Axiomatizations of logics with values in groups. (55 #2484)

Mart'janov, V. I. The theory of abelian groups with predicates that distinguish subgroups and with endomorphism operations. (Russian) en(55 #12513)

Paillet, Jean-Luc Résultats relatifs à l'existence de structures  $n$ -élémentaires. (English summary) (55 #95)

Slobodskoi, A. M. (with Fridman, È. I.) Theories of abelian groups with predicates that distinguish subgroups. (Russian) (55 #12512)

Stoller, G. S. Three problems of S. M. Ulam with solutions and generalizations. (55 #7778)

### 20A99 None of the above, but in this section

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## 20Bxx Finite permutation groups

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Higman, D. G. A survey of some questions and results about rank 3 permutation groups. 55 #467

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### 20B15 Uniprimitive groups

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O'Nan, Michael E. Estimation of Sylow subgroups in primitive permutation groups. 56 #3098

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### 20B25 Automorphism groups of algebraic, geometric, or combinatorial structures [See also 05Bxx, 20G40, 20H30, 50-XX.]

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Plaumann, Peter Automorphismengruppen diskreter Gruppen als topologische Gruppen. (56 #12167)

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 See also Nobs, Alexandre, **(55** #2753a) and Nobs, Alexandre, **56** #3136

## 20G10 Cohomology theory

- Čerednik, I. V. The analogue of Cartan duality over  $p$ -adic fields. (Russian) **(55** #5592)  
 Cline, Edward (with Parshall, Brian; Scott, Leonard L.; van der Kallen, Wilberd) Rational and generic cohomology. **(55** #12737)  
 (with Parshall, Brian; Scott, Leonard L.) Cohomology of finite groups of Lie type. II. **55** #8201  
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 Scott, Leonard L. Matrices and cohomology. **(56** #5746)  
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 Suhanov, A. A. Observable subgroups of a complex semisimple Lie group. (Russian. English summary) **56** #12140

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- Borevič, Z. I. Description of the subgroups of the general linear group that contain the group of diagonal matrices. (Russian) **56** #5734  
 Brodskii, I. B. The invariants of unipotent groups. (Russian) **55** #5757  
 Burgoyne, N. (with Williamson, C.) On a theorem of Borel and Tits for finite Chevalley groups. **55** #3098  
 Čistov, A. L. The birational equivalence of tori with a cyclic splitting field. (Russian) **(56** #8578)  
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 Dempwolff, Ulrich (with Wong, S. K.) Another characterization of  $L_n(2)$ . **55** #3099  
 Dye, R. H. A geometric characterization of the special orthogonal groups and the Dickson invariant. **(56** #11899)  
 Goto, Morikuni On an integer associated with an algebraic group. **(55** #2934)  
 Isaacs, I. M. Linear groups as stabilizers of sets. **55** #521  
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- Benenti, Sergio Su di una particolare classe di rotazioni negli spazi quadridimensionali non minkowskiani. (English summary) **(55** #7919)  
 Białynicki-Birula, Andrzej Some properties of the decompositions of algebraic varieties determined by actions of a torus. (Russian summary) **(56** #12020)  
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 Britto, Juliet On defining a subgroup of the special linear group by a congruence. **(56** #11904)  
 Burgoyne, N. (with Cushman, R.) Conjugacy classes in linear groups. **55** #5761  
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- Dixon, John D.** Rigid embedding of simple groups in the general linear group. **55** #8202
- Dorfmeister, J.** (with Koecher, Max) Relative Invarianten und nicht-assoziative Algebren. **(56** #438)
- Herb, Rebecca A.** (with O'Brian, Nigel R.) A characterization of unipotent, semisimple and regular elements in a reductive algebraic group. **56** #15786
- Hochschild, G.** Automorphism groups of complex Lie algebras. **(55** #2938)
- Huffman, W. Cary** (with Wales, David B.) Linear groups containing an involution with two eigenvalues  $-1$ . **55** #8203
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- Kopylova, T. I.** Finite irreducible solvable groups of matrices of prime order. (Russian) **55** #10573
- Magid, Andy R.** Analytic left algebraic groups. **(56** #5577)
- Majeed, Abdul** Reducible and irreducible 2-generator subgroups of  $SL(2, C)$ . **(56** #15670)
- Freeness of the group  $\langle a^n, b^n \rangle$  for some integer  $n$ ,  $a, b \in SL(2, C)$ . **55** #3102
- Nishikawa, Mitsuru** Exponential image in the real general linear group. **56** #494
- O'Brian, Nigel R.** See **Herb, Rebecca A.**, **56** #15786
- Segikuchi, Jirô** On an example of an irreducible prehomogeneous vector space. (Japanese) **56** #3141
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- Smith, Stephen D.** Sylow automizers of odd order. **55** #12804
- Vaseršteĭn, L. N.** The group  $SL_2$  over Dedekind rings of arithmetic type. (Russian) **(55** #8253)
- Wales, David B.** See **Huffman, W. Cary**, **55** #8203

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- Borevič, Z. I.** Parabolic subgroups in the special linear group over a semilocal ring. (Russian. English summary) **55** #12827
- Dani, J. S.** Density properties of orbits under discrete groups. **(56** #2920)
- Diarra, Bertin** Ultra-produits de corps munis d'une valeur absolue ultra-métrique. (English summary) **(56** #2816)
- James, D. G.** The structure of local integral orthogonal groups. **55** #8204
- Margulis, G. A.** Cobounded subgroups in algebraic groups over local fields. (Russian) **56** #495
- Prasad, Gopal** Strong approximation for semi-simple groups over function fields. **(56** #2921)
- Suslin, A. A.** On a theorem of Cohn. (Russian) **56** #5736

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- Ash, Avner** Deformation retracts with lowest possible dimension of arithmetic quotients of self-adjoint homogeneous cones. **55** #522
- Bondarenko, A. A.** On the classification of maximal arithmetic subgroups in split groups. (Russian) **(56** #12177)
- Dybkoĭa, E. V.** Some congruence subgroups of the symplectic group. (Russian) **56** #15787
- Igusa, Jun-ichi** Exponential sums associated with a Freudenthal quartic. **(56** #5455)
- Jančevskii, V. I.** Reduced unitary  $K$ -theory. (Russian) **(55** #12760)
- Krjuckov, A.** Arithmetical invariants of a class of algebraic tori. (Russian. Estonian and English summaries) **(56** #5566)
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- Serre, Jean-Pierre** Groupes discrets-compactifications. **55** #3103
- Shyr, Jih Min** A generalization of Dirichlet's unit theorem. **55** #10574

## 20G35 Linear algebraic groups over adèles and other rings and schemes

- Demazure, Michel** Automorphismes et déformations des variétés de Borel. **(55** #8054)
- Djoković, Dragomir Ž.** Products of dilatations. **56** #8712
- Drobotenko, V. S.** (with Pogoriljak, E. Ja.) Automorphisms of the general linear group over a noncommutative semilocal ring. (Russian) **56** #8713
- Gattazzo, Remo** Sottogruppi  $Q$ -congruenziali di  $SL(n, R)$ . (English summary) **56** #15788
- Krjuckov, A.** Arithmetical invariants of a class of algebraic tori. (Russian. Estonian and English summaries) **(56** #5566)
- O'Meara, O. T.** A general isomorphism theory for linear groups. **55** #523
- Phadke, B. B.** Products of transvections. **56** #5737
- Piccard, Sophie** Les groupes de transformations périodiques des entiers rationnels. II. **55** #3104
- Pogoriljak, E. Ja.** Automorphisms of the group of second order matrices over a commutative local ring. (Russian) **56** #12141
- See also **Drobotenko, V. S.**, **56** #8713
- Suzuki, Kazuo** On normal subgroups of twisted Chevalley groups over local rings. **56** #5738

## 20G40 Linear algebraic groups over finite fields

- Alperin, J. L.** Quadratic fours groups. **55** #10575
- Andrews, George E.** Partitions,  $q$ -series and the Lusztig-Macdonald-Wall conjectures. **(56** #5307)
- Burgoyne, N.** (with Griess, R.; Lyons, Richard) Maximal subgroups and automorphisms of Chevalley groups. **56** #3142
- Burns, Robert G.** (with Farouqi, I. H.) Maximal normal subgroups of the integral linear group of countable degree. **55** #3105
- Farouqi, I. H.** See **Burns, Robert G.**, **55** #3105
- Griess, R.** See **Burgoyne, N.**; et al., **56** #3142
- Harish-Chandra** Eisenstein series over finite fields. **(56** #15784)
- Husnine, Syed Muhammad** A characterization of the Chevalley group  $F_4(2)$ . **55** #524

- Iwasaki, Shiro** Primitive extensions of rank 3 of  $2^n \cdot GL(n, 2)$ . **55** #8205
- Ketter, T. A.** (with Lehrer, Gustav I.) On conjugacy classes in certain isogenous groups. **55** #3106
- Lehrer, Gustav I.** Characters, classes, and duality in isogenous groups. **55** #5762
- Some incidence structures of maximal rank. **55** #8206
- See also **Ketter, T. A.**, **55** #3106
- Lyons, Richard** See **Burgoyne, N.**; et al., **56** #3142
- Phan, Kok Wee** On groups generated by three-dimensional special unitary groups. I. **55** #8207
- On groups generated by three-dimensional special unitary groups. II. **56** #5739
- Strickland, Elisabetta** Sui funtori coniugio nei gruppi  $PSL(2, p^f)$ . (English summary) **56** #3143
- Tits, Jacques** Non-existence de certains polygones généralisés. I. **55** #8208

## 20G45 Applications to physics; explicit representations

## 20G99 None of the above, but in this section

- Springer, T. A.** ★Invariant theory. **56** #5740

## 20Hxx Other groups of matrices

## 20H05 Unimodular groups, congruence subgroups

- Abe, Eiichi** (with Suzuki, Kazuo) On normal subgroups of Chevalley groups over commutative rings. **55** #12828
- Borevič, Z. I.** (with Tolasov, B. A.) Net normal subgroups of the general linear group. (Russian) **56** #5741
- Britto, Juliet** On the construction of noncongruence subgroups. **56** #12142
- Dybkoĭa, E. V.** Some congruence subgroups of the symplectic group. (Russian) **(56** #15787)
- Suzuki, Kazuo** See **Abe, Eiichi**, **55** #12828
- Tolasov, B. A.** See **Borevič, Z. I.**, **56** #5741
- Vavilov, N. A.** Parabolic congruence subgroups in linear groups. (Russian) **56** #5742

## 20H10 Fuchsian groups and their generalizations [See also 30A58, 32Nxx.]

- Larsen, Leif** On the computability of conjugate powers in finitely generated Fuchsian groups. **56** #12143
- Matejski, J. Peter** A compactness theorem for Fuchsian groups of the second kind. **(55** #5900)
- Patterson, S. J.** The limit set of a Fuchsian group. **(56** #8841)
- Stothers, W. Wilson** Subgroups of the  $(2, 3, 7)$  triangle group. **(56** #2923)
- Zieschang, H.** Triangular groups. (Russian) **56** #15789
- Zimmermann, Bruno** Eine Verallgemeinerung der Formel von Riemann-Hurwitz. **56** #8714

## 20H15 Other geometric groups, including crystallographic groups [See also 50-XX.]

- Agyei, A. K.** (with Birman, J. L.) A new group-theoretical approach to cell-preserving phase transitions in crystals. **56** #8715
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- Deodhar, Vinay V.** Some characterizations of Bruhat ordering on a Coxeter group and determination of the relative Möbius function. **55** #8209
- Heimbeck, Günter** Zur gruppentheoretischen Kennzeichnung elliptischer Bewegungsgruppen. **56** #5743
- Herzog, Marcel** (with Lehrer, Gustav I.) A note concerning Coxeter groups and permutations. **56** #8716
- Hollander, David H.** An unexpected two-dimensional space-group containing seven of the twelve basic solutions to the eight queens problem. **55** #3107
- Huppert, B.** Zur Konstruktion der reellen Spiegelungsgruppe  $\mathfrak{S}_4$ . **56** #15790
- Lehrer, Gustav I.** See **Herzog, Marcel**, **56** #8716
- Macdonald, Sheila Oates** (with Street, Anne Penfold) On crystallographic colour groups. **55** #525
- Milnor, John W.** Hilbert's problem 18: on crystallographic groups, fundamental domains, and on sphere packing. **55** #3108
- Plesken, Wilhelm** The Bravais group and the normalizer of a reducible finite subgroup of  $GL(n, \mathbb{Z})$ . **55** #12829
- Street, Anne Penfold** See **Macdonald, Sheila Oates**, **55** #525
- Walker, Michael** On the structure of finite collineation groups containing symmetries of generalized quadrangles. **(55** #13337)
- Wolowiec, Piotr** On a certain class of  $n$ -dimensional space groups. **56** #496

## 20H20 Other matrix groups over fields

- Charnow, A.** A note on torsion free groups generated by pairs of matrices. **55** #10576
- Lichtman, A. I.** On subgroups of the multiplicative group of skew fields. **56** #5744
- Sizer, Walter S.** Triangularizing solvable groups of unipotent matrices over a skew field. **56** #3144

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- Apanasov, B. N.** The relation between the group  $SL(n, Z)$  and the  $n$ -dimensional modular group. (Russian) **55** #3109
- Piccard, Sophie** Le groupe sature  $G_m$  de transformations périodiques, de période entière  $n \geq 2$ , de l'ensemble  $Z$  des entiers rationnels. **55** #5763
- Suzuki, Kazuo** On parabolic subgroups of Chevalley groups over commutative rings. **(56** #5580)



20H30 Other matrix groups over finite fields

20H99 None of the above, but in this section

## 20Jxx Connections with homological algebra and category theory

20J05 Homological methods in group theory

- Bass, Hyman** Euler characteristics and characters of discrete groups. **55** #5764  
**Bercov, R. D.** See **Pandya, G. N.**, **55** #526  
**Cline, Edward** (with Parshall, Brian; Scott, Leonard L.) Cohomology of finite groups of Lie type. II. (**55** #8201)  
**Evens, Leonard** The spectral sequence of a finite group extension stops. (**55** #3032)  
**Kumar, Kiran** Extension of groups. **55** #10577  
**Lausch, Hans** Relative cohomology of groups. **56** #5745  
**Leedham-Green, C. R.** (with McKay, Susan) Baer-invariants, isologism, varietal laws and homology. **55** #8210  
**Lue, Abraham S.-T.** The Ganea map for nilpotent groups. **55** #3110  
**Martínez, Juan José** Cohomological dimension of a group with respect to finite modules. **55** #10578  
**McKay, Susan** See **Leedham-Green, C. R.**, **55** #8210  
**Pandya, G. N.** (with Bercov, R. D.) 1-cohomology and splitting of group extensions. **55** #526  
**Parshall, Brian** See **Cline, Edward**; et al., (**55** #8201)  
**Schafer, James A.** Poincaré complexes and one-relator groups. **56** #15791  
**Schneebeli, Hans Rudolf** ★Virtuelle Eigenschaften in der Gruppentheorie und virtuelle Cohomologie. **56** #15792  
**Scott, Leonard L.** Matrices and cohomology. **56** #5746  
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**Strebel, Ralph** A homological finiteness criterion. (**55** #3030)  
 A remark on subgroups of infinite index in Poincaré duality groups. **56** #15793  
**(Venkov, B. B.)** See **Modules and homology in group theory and Galois theory**, **56** #8717  
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**Modules and homology in group theory and Galois theory** ★Modules and homology in group theory and Galois theory. **56** #8717

20J10 Groups arising as cohomology groups

- Pollatsek, Harriet** First cohomology groups of some orthogonal groups. **56** #12144  
**Roque, Jean-Louis** Annulation des groupes d'homologie et de cohomologie des groupes nilpotents de type fini. (English summary) **56** #3145

20J15 Category of groups

20J99 None of the above, but in this section

## 20Kxx Abelian groups

20K05 Finitely generated groups

- Tineo, Antonio** ★Grupos finitamente generados. (Spanish) [Finitely generated groups] **56** #8718

20K10 Torsion groups

- Basarab, Șerban A.** On the elementary theories of abelian profinite groups and abelian torsion groups. (**55** #12508)  
**Benabdallah, Khalid** (with Bradley, Robert) Sur les groupes quasi-purs-projectifs torsions. **55** #527  
**Boschhoff, C. J.** A note on fine subgroups. (Afrikaans summary) **55** #12830  
**Bradley, Robert** See **Benabdallah, Khalid**, **55** #527  
**Eklof, Paul C.** Categories of local functors. (**55** #7766)  
**Fuchs, László** On  $p^{w+n}$ -projective abelian  $p$ -groups. **55** #528  
**Hales, Alfred W.** Ultrafilters and Abelian groups. **55** #10579  
**Linton, Ronald** (with Megibben, Charles) Extensions of totally projective groups. **56** #8719  
**May, Warren** (with Toubassi, Elias) Embedding of totally projective groups. **56** #15794  
**Megibben, Charles** See **Linton, Ronald**, **56** #8719  
**Molloy, Todor Ž.** Sylow  $p$ -subgroups of group algebras of countable abelian groups over a field of characteristic  $p$ . (Russian) (**56** #456)  
**Schoeman, M. J.** Injective properties of torsion-complete mixed groups. **56** #12145  
**Toubassi, Elias** See **May, Warren**, **56** #15794  
**Yoshida, Fumio** On abelian  $p$ -groups satisfying certain conditions on heights. **55** #3111

20K15 Torsion free groups, finite rank

- Arnold, D.** (with Vinsonhaler, C. I.; Wickless, W. J.) Quasi-pure projective and injective torsion free abelian groups of rank 2. **56** #3146  
**Bican, Ladislav** The splitting length of mixed abelian groups of rank one. **55** #5765  
**De Marco, G.** On the algebraic compactness of some quotients of product groups. **56** #497  
**Fomin, A. A.** The tensor product of countable abelian torsion-free groups. (Russian) **56** #3147  
**Gardner, B. J.** (with Jackett, D. R.) Rings on certain classes of torsion-free abelian groups. **56** #15795  
**Jackett, D. R.** See **Gardner, B. J.**, **56** #15795  
**Krylov, P. A.** Torsion-free abelian groups with cyclic  $p$ -basic subgroups. (Russian) **56** #498

- Vinsonhaler, C. I.** See **Arnold, D.**; et al., **56** #3146  
**Webb, M. C.** A bound for the nilstufe of a group. **56** #15796  
**Wickless, W. J.** See **Arnold, D.**; et al., **56** #3146

20K20 Torsion free groups, infinite rank

- Benabdallah, Khalid** (with Bradley, Robert) Sur les groupes quasi-purs-projectifs sans torsion. **55** #12831  
**Bradley, Robert** See **Benabdallah, Khalid**, **55** #12831  
**Eklof, Paul C.** Infinitary model theory of abelian groups. (**56** #11778)  
 (with Mekler, Alan H.) On constructing indecomposable groups in  $L$ . (**56** #15412)  
**Huber, Martin** Sur le problème de Whitehead concernant les groupes abéliens libres. (English summary) (**55** #98)  
 Sur les groupes abéliens de la forme  $\text{Ext}(A, G)$ . (English summary) (**56** #5288)  
**Mader, A.** Finite order extensions of a primary group by a torsion-free group. **55** #8211  
**Mekler, Alan H.** See **Eklof, Paul C.**, (**56** #15412)  
**O'Neill, John D.** An uncountable Noetherian ring with free additive group. **56** #8720  
**Webb, Cary** Corrigendum: "Transformations on tensor products and the torsionless property in abelian groups" (Bull. Austral. Math. Soc. **14** (1976), 389–396). **55** #10580

20K25 Direct sums, direct products, etc.

- Hunter, Roger** (with Richman, Fred; Walker, Elbert A.) Finite direct sums of cyclic valued  $p$ -groups. **55** #8212  
**Koyama, Toshiko** On a characterization of quasi-complete  $p$ -groups. **56** #3148  
**Richman, Fred** See **Hunter, Roger**; et al., **55** #8212  
**Walker, Elbert A.** See **Hunter, Roger**; et al., **55** #8212

20K30 Automorphisms, homomorphisms, endomorphisms

- d'Este, Gabriella** Sui gruppi abeliani il cui anello degli endomorfismi è numerabile e non discreto nella topologia finita. **56** #3149  
**Hausen, Jutta** How automorphism groups reveal Ulm invariants. **56** #499  
 The Jacobson radical of endomorphism rings of totally projective groups of finite type. (**56** #8604)  
**Ibrahim, A. Shawk** Existence theorem for abelian groups. (Arabic summary) **56** #8721  
**Larin, S. V.** Abelian groups that admit a fixed point free automorphism of order  $q^n$ . (Russian) **56** #3150  
**Lavis, A.** Prolongement simultané d'une famille d'endomorphismes partiels ouverts dans les groupes topologiques commutatifs. (English summary) (**56** #5774)  
**van Leeuwen, Leo C. A.** On endomorphisms and quasi-endomorphisms of torsionfree groups. **56** #15797  
**Rangaswamy, K. M.** Endomorphism representations of Zorn rings and subclasses of rings with enough idempotents. (**56** #8608)  
**Spoletini Cherubini, Alessandra** Gli FA-gruppi abeliani periodici. (English summary) **56** #500

20K35 Extensions

- Eklof, Paul C.** Homological algebra and set theory. (**56** #11782)  
**Kuz'minov, V. I.** Groups of pure extensions of abelian groups. (Russian) **56** #12146  
**Nordahl, Thomas** Abelian groups and  $N$ -semigroups. II. **55** #529

20K40 Homological and categorical methods [See also 18H10.]

- Cook, Donald** Subfunctors of Hom. **55** #8213

20K45 Topological methods

- Bowman, Harold** See **Moore, J. Douglas**, **56** #5747  
**Hackler, Donald** Compact groups of real power need not be metrizable. (**56** #1271)  
**Moore, J. Douglas** (with Bowman, Harold) A method for obtaining proper classes of short exact sequences of abelian groups. **56** #5747

20K99 None of the above, but in this section

- Bečvář, Jindřich**  $K$ -essential subgroups of abelian groups. I. **55** #12832  
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 $K$ -essential subgroups of abelian groups. III. **55** #12834  
**Beutler, Eckart** An idealtheoretic characterization of varieties of abelian  $\Omega$ -groups. (**56** #8466)  
**Dobrica, V. P.** Computability of certain classes of constructive algebras. (Russian) (**56** #5244)  
**Feigelstock, Shalom** On the type set of groups and nilpotence. **56** #3151  
 The absolute annihilator of an abelian group modulo a subgroup. **56** #8722  
**Fujii, Kensō** A note on finite groups which act freely on closed surfaces. II. **55** #8214  
**Huber, Martin** Caractérisation des groupes abéliens libres, et cardinalités. (English summary) **56** #501  
**Janakiraman, S.** A note on abelian groups. **56** #12147  
 (with Rangaswamy, K. M.) Strongly pure subgroups of abelian groups. **56** #5748  
**Kokorin, A. I.** See **Kozlov, G. T.**, (**56** #11729)  
**Kozlov, G. T.** (with Kokorin, A. I.) Proof of a lemma on model completeness. (Russian) (**56** #11729)  
**Lesko, Karen M.** A generalization to almost divisible groups. **56** #3152  
**Olson, John E.** An addition theorem for finite abelian groups. **55** #10581  
**Peake, E. J., Jr.** On Serre classes of abelian groups. **56** #502  
**Pierce, Keith R.** Amalgamated sums of abelian  $l$ -groups. (**55** #2702)



- Rangaswamy, K. M. *See* Janakiraman, S., 56 #5748
- Rogers, Laurel A. Ulm's theorem for partially ordered structures related to simply presented abelian  $p$ -groups. 56 #503
- Rosošek, C. K. The isomorphism of equivalent abelian groups. (Russian) 55 #5766
- Surányi, János A certain way of presenting finite abelian groups. (Hungarian. English summary) 55 #12835
- Teschke, Lothar Über die Untergruppen der elementarabelschen Gruppen. 56 #3153
- Yahya, S. M. On cogenerators in abelian groups. 55 #3112

## 20Lxx Groupoids (small categories in which all morphisms are isomorphisms)

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- Combinatorics See Quasigroups and combinatorics, (56 #19)
- Quasigroups and combinatorics ★Квасигруппы и комбинаторика. (Russian) [Quasigroups and combinatorics] (56 #19)

20N05 Loops, quasigroups [See also 05Bxx.]

- Alimpić, Branka P.** A class of balanced laws on quasigroups. I. 55 #548  
A class of balanced laws on quasigroups. II. 55 #549

- Basarab, A. S.** On the theory of generalized Bol loops. (Russian) 55 #10596
- Beg, Afzal** A theorem on C-loops. 55 #12853  
(with Khan, Mohd. Rais) On special class of Bol loops. 56 #8738
- Beljavskaja, G. B.**  $r$ -orthogonal quasigroups. I. (Russian) 55 #8233  
 $r$ -orthogonal quasigroups. II. (Russian) 56 #12162
- Belousov, Valentin D.** A generalized mean value equation. (Russian) 55 #8234  
(with Stojaković, Zoran M.) Infinitary quasigroups. 55 #3131  
See also Nets and quasigroups, 55 #3133
- Benetait, Lucien** Les groupes de Fischer au sens restreint: dimension, et classe de nilpotence du dérivé. (English summary) (56 #15776)
- Bol'bot, A. D.** Imbedding of cancellation semigroups in mono-associative  $IP$ -loops. (Russian) 56 #8739
- Burdujan, Ilie** Certain remarks on the geometry of quasigroups. (Russian) 55 #8235
- Čeban, A. M.**  $B$ -loops. (Russian) 56 #3172
- Chaladus, Stefan** On weak associative laws in commutative  $IP$ -loops. 55 #12854
- Cruse, Allan B.** See Lindner, Charles C., 55 #5779
- Dement'eva, V. I.** Automorphisms of  $k$ -nets. (Russian) 56 #515
- Duplák, Ján** Rot-quasigroups as isotopes of abelian groups. (Russian summary) 55 #550
- Gluhov, M. M.** (with Muhin, A. I.) Equations over quasigroups. (Russian) 56 #12163
- Hauptfleisch, G. J.** See Vermeulen, J., 55 #553
- Ježek, Jaroslav** (with Kepka, Tomáš) Varieties of Abelian quasigroups. 56 #8740
- Karklin', V. B.** See Karklin's, B. B., 56 #516
- Karklin's, B. B.** (with Karklin', V. B.) Inverse loops. (Russian) 56 #516
- Kepka, Tomáš** Quasigroups which satisfy certain generalized forms of the Abelian identity. 55 #8236  
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- Khan, Mohd. Rais** See Beg, Afzal, 56 #8738
- Kikkawa, Michihiko** On the left translations of homogeneous loops. 55 #5778
- Kitoroagė, M. D.** Certain isotopes of  $A$ -quasigroups. (Russian) 56 #517
- Lindner, Charles C.** (with Cruse, Allan B.) Small embeddings for partial semisymmetric and totally symmetric quasigroups. 55 #5779  
Intersection preserving finite embedding theorems for partial quasigroups. 55 #12855
- Livšć, E. S.** Balanced functional equations of the first kind on quasigroups of arbitrary arity. (Russian) (55 #10894)
- Movsisjan, Ju. M.** Generalized distributivity identities of nonzero rank. (Russian. Armenian summary) (55 #5502)
- Muhin, A. I.** See Gluhov, M. M., 56 #12163
- Murathudzaev, S.** Groups of regular permutations in a  $TS$ - $n$ -quasigroup. (Russian) 56 #518
- Robinson, D. A.** A special embedding of Bol loops in groups. 56 #15813
- Sabinin, L. V.** See Sharma, B. L., 55 #3132
- Sadovnikov, E. M.** The amalgamation of the nuclei of a loop. (Russian) 55 #12856
- Sathyabhama, V.** Generalized LC-identity on GD-groupoids. (Czech and loose Russian summaries) 56 #12164
- Sharma, B. L.** (with Sabinin, L. V.) On the existence of half-Bol loops. 55 #3132  
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Left loops which satisfy the left Bol identity. II. 56 #3173
- Stojaković, Zoran M.** Balanced laws on ternary GD-groupoids. 56 #15815  
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- Strambach, Karl** Kommutative distributive Quasigruppen. 56 #519
- Ušan, Jánecz** Globally associative systems of  $n$ -ary quasigroups. (Construction of  $iA$ -systems. A generalization of a theorem of Hosszú and Gluskin). (Russian) 55 #551  
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- Vermeulen, J.** (with Hauptfleisch, G. J.) Homogeneous loops. (Afrikaans. English summary) 55 #553
- Nets and quasigroups** ★Сети и квазигруппы. (Russian) [Nets and quasigroups] 55 #3133
- Quasigroups** See Nets and quasigroups, 55 #3133

20N10 Ternary systems (heaps, semiheaps, heapoids, etc.)

- Bektenov, A. S.** Certain properties of a spatial 3-dimensional net and its coordinate ternary quasigroup. (Russian) (55 #11158)
- Creangă, Ion** (with Zitron, Carmen) Quelques remarques sur la division dans des structures ternaires. (Romanian summary) 55 #5780
- Gasano, A. M.** Ternary semigroups of continuous mappings. (Russian. Azerbaijani and English summaries) 56 #520
- Hestenes, Magnus R.** On a ternary algebra. 56 #3174
- Klouda, Josef** Ternary rings associated to translation plane. (55 #11143)
- Konstantinova, L. I.** Translations of inverse semiheaps. (Russian) 55 #5781
- Milici, Salvatore** Caratterizzazioni geometriche di alcune particolarità dei sistemi ternari. 55 #3134
- Mustafaev, L. G.** Semiheaps of topological mappings. (Russian) 55 #12857  
A semiheap of continuous open mappings. (Russian) 55 #8237
- Schreckenberger, Jürgen** Über die Faktoralgebren von Scharoiden. 55 #554
- Zitomirskii, G. I.** Varieties of generalized heaps. (Russian) 56 #3175
- Zitron, Carmen** See Creangă, Ion, 55 #5780

20N15  $n$ -ary systems

- El'kin, L. N.** On the question of simple positional operatives. (Russian) 56 #8741
- Frenkin, B. R.** The reducibility of  $n$ -quasigroups. (Russian) 56 #15817  
Reducible  $n$ -quasigroups and their isotopes. (Russian) 56 #521
- Gluskin, L. M.** (with Švarc, V. Ja.) Bands of operatives. (Russian) 56 #15818
- Kolesnikov, O. V.** On the theory of  $n$ -semigroups. (Russian. English summary) 56 #8742



- Němec, Petr Totally simple  $n$ -groupoids and  $n$ -quasigroups. (Russian) **56** #5765  
 Sandik, M. D. Invertible multi-operations and permutations. (Russian) **56** #522  
 Sokolov, E. I. The Gluskin-Hosszú theorem for Dörnte  $n$ -groups. (Russian) **56** #523  
 (with Sokolova, L. A.) Quasigroups with the generalized inverse property. (Russian) **56** #524  
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 Sureau, Yves Sous-hypergroupe engendré par deux sous-hypergroupes et sous-hypergroupe ultra-clos d'un hypergroupe. (English summary) **55** #5782  
 Une notion de conjugaison dans les hypergroupes et hypergroupes homomorphes à un groupe. (English summary) **55** #5783  
 Švarc, V. Ja. See Gluskin, L. M., **56** #15818  
 Topenčarov, V. V. Éléments de la théorie des catégories polyadiques. (**56** #3086)  
 Ušan, Janez (with Žižovič, Mališa) An  $n$ -ary analogue of a theorem of Schaeffer. (Russian) **55** #555  
 Žižovič, Mališa See Ušan, Janez, **55** #555

20N99 None of the above, but in this section

- Eigenthaler, G. Eine Anwendung eines Satzes von Gaschütz auf Polynompermutationen über endlichen Multioperatorgruppen. (**56** #5394)  
 Močkoř, Jiří A realization of  $d$ -groups. (Loose Russian summary) **56** #5766

## 22-XX TOPOLOGICAL GROUPS, LIE GROUPS [For transformation groups, see 54H15, 57Exx, 58-XX. For abstract harmonic analysis, see 43-XX.]

22-01 Elementary exposition (collegiate level)

- Goto, Morikuni ★An introduction to topological groups. **55** #3137  
 Kržanič, France ★Liejeve grupe. (Slovenian) [Lie groups] **56** #525  
 Price, John F. ★Lie groups and compact groups. **56** #8743  
 Ström, Staffan Introduction to the theory of groups and group representations. I. **55** #8238  
 Weyl, Hermann ★Gruppentheorie und Quantenmechanik. **56** #8744

22-02 Advanced exposition (research surveys, etc.)

- Hofmann, Karl Heinrich Category theoretical methods in topological algebra. **56** #15819

22-03 Historical

- (Klein, F.) See Vizgin, V. P., (**56** #11708)  
 Vizgin, V. P. On the history of F. Klein's "Erlanger Programm". (Russian) (**56** #11708)

22-04 Explicit machine computation and programs (not the theory of computation or programming)

22-06 Collections of papers; proceedings of conferences

- (Bacry, H.) See Group theoretical methods in physics, (**55** #4964)  
 (Carmona, J.) See Non-commutative harmonic analysis, **56** #527  
 (Grossmann, A.) See Group theoretical methods in physics, (**55** #4964)  
 (Vega, Jossie) See Non-commutative harmonic analysis, **56** #527  
 (Vergne, M.) See Non-commutative harmonic analysis, **56** #527  
 Colloque:  
 Analyse Harmonique Non-Commutative See Non-commutative harmonic analysis, **56** #527  
 Colloquium:  
 Group Theoretical Methods in Physics See Group theoretical methods in physics, (**55** #4964)  
 Differential equations See Invariant differential equations in symmetric spaces, **56** #526  
 Group theoretical methods in physics ★Group theoretical methods in physics. (**55** #4964)  
 Harmonic analysis See Non-commutative harmonic analysis, **56** #527  
 Invariant differential equations in symmetric spaces ★Invariant differential equations in symmetric spaces. **56** #526  
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 Non-commutative harmonic analysis ★Non-commutative harmonic analysis. **56** #527  
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 Invariant Differential Equations in Symmetric Spaces See Invariant differential equations in symmetric spaces, **56** #526

## 22Axx Topological algebraic systems [For topological rings and fields, see 12Jxx, 13Jxx, 16A80; for dual spaces of operator algebras and topological groups, see 46L05.]

- (Rjabuhin, Ju. M.) See Topological structures and algebraic systems, **56** #12165  
 Algebraic systems See Topological structures and algebraic systems, **56** #12165  
 Topological structures and algebraic systems ★Топологические структуры и алгебраические системы. (Russian) [Topological structures and algebraic systems] **56** #12165

22A05 Structure of general topological groups

- Čarin, V. S. A class of topological FC-groups. (Russian) (**56** #15823)  
 Citric'kii, O. E. The duality of weakly locally convex groups. (Russian) **55** #5784  
 Comfort, W. W. (with Itzkowitz, G. L.) Density character in topological groups. **56** #5767

- Gait, Jason The Baire set fixing property and uniform continuity in topological groups. **56** #8745  
 Higgins, Philip J. Coproducts of topological abelian groups. **56** #15820  
 Homenko, S. P. The extraction of roots in topological groups. (Russian) **55** #3138  
 Islamov, A. N. Self-generating topological lattice-ordered groups. (Russian. Uzbek summary) (**55** #7880)  
 Itzkowitz, G. L. See Comfort, W. W., **56** #5767  
 Kelly, N. See Morris, Sidney A., **56** #12166  
 Kramarev, B. A. Topological groups with invariant centralizers of the elements. (Russian) **55** #12858  
 Lamartin, W. F. Epics in the category of  $T_2$   $k$ -groups need not have dense range. **55** #556  
 Lavis, A. Extensions de groupes topologiques commutatifs. (English summary) **55** #3139  
 Miller, Douglas E. On the measurability of orbits in Borel actions. (**55** #13394)  
 Morris, Sidney A. Locally compact groups and  $\beta$ -varieties of topological groups. **55** #3140  
 (with Kelly, N.) Varieties of topological groups generated by groups with invariant compact neighbourhoods of the identity. **56** #12166  
 The variety of topological groups generated by the free topological group on  $[0, 1]$ . **55** #12859  
 Connected and locally connected closed subgroups of products of locally compact abelian groups. **55** #8239  
 Nickolas, Peter Subgroups of the free topological group on  $[0, 1]$ . **56** #15821  
 Ordman, Edward T. Free  $k$ -groups and free topological groups. **55** #557  
 Pérez Carreras, Pedro  $K$ -Suslin spaces and topological groups. (Spanish. English summary) **55** #558  
 Pettis, B. J. Closed graph and open mapping theorems in certain topologically complete spaces. (**56** #9219)  
 Addition to the note: "Closed graph and open mapping theorems in certain topologically complete spaces" (Bull. London Math. Soc. **6** (1974), 37-41). (**56** #9220)  
 Protasov, I. V. A problem of I. Kaplansky. (Russian. English summary) **55** #3141  
 Šmarda, Bohumil Connectivity in  $tl$ -groups. (**56** #5387)  
 Tabor, J. Regular extensions of algebraic objects. **55** #3142

22A10 Analysis on general topological groups

- Fedotov, V. P. Differentiability in topological groups. (Russian) (**56** #16667)  
 Frič, Roman On continuous characters of Borel sets. **55** #10597  
 Marxen, Donald Neighborhoods of the identity of the free abelian topological groups. **55** #5785

22A15 Structure of topological semigroups

- Baird, Bridget Bos Embedding inverse semigroups of homeomorphisms on closed subsets. **56** #3176  
 Barabaš, V. V. Duality and reflexivity of compact semigroups. (Russian) **55** #10598  
 Bertman, M. O. (with West, T. T.) Conditionally compact bicyclic semitopological semigroups. **55** #3143  
 Brown, D. R. (with Stralka, A. R.) Compact totally instable zero-dimensional semilattices. **55** #3144  
 Brown, Gavin (with Moran, William) On the weak operator closure of the powers of a unitary operator. **56** #5768  
 Chae, Younki A study on topological multi-semigroups. **56** #528  
 Chow, H. L. Remarks on boundaries in semigroups. **55** #3145  
 Radicals and semiprime ideals in semigroups. **56** #5769  
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 Ganci, J. J. (with Lawson, Jimmie D.) Principal semigroup bundles. (**55** #4166)  
 Gierz, Gerhard (with Keimel, Klaus) Topologische Darstellung von Verbänden. **55** #8240  
 Gluskin, L. M. (with Šain, B. M.; Šneperman, L. B.; Jaroker, I. S.) Addendum to: "A survey of semigroups of continuous selfmaps" (Semigroup Forum **11** (1975/76), no. 3, 189-282) by K. D. Magill. (**56** #3168)  
 Guo, Mai See Kranz, Przemysław, **56** #8746  
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 Lau, A. Y. W. Existence of  $n$ -cells in Peano semilattices. **55** #3148  
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 McMorris, J. E. The topological structure of planar closed spirals which support clans. **55** #3150  
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- Reichel, Hans-Christian** (*with* Ruppert, Wolfgang) Über Distanzfunktionen mit Werten in angeordneten Halbgruppen. (English summary) (55 #12595)
- Remage, Russell** Compact orbit-decomposition acts. (55 #8241)
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- Šain, B. M.** See **Gluskin, L. M.**; et al., (56 #3168)
- Schneider, Victor P.** Compactifications for some semigroups using the Whyburn construction. (55 #10599)
- Selden, Annie Alexander** The kernel of the determining endomorphism of a bisimple  $\omega$ -semigroup. (56 #3179)
- Shum, Kar Ping** On the Frattini ideal in compact semigroups. (Russian summary) (55 #5559)
- Skrjago, A. M.** The homotopy properties of certain continuous semigroups. (Russian) (55 #10600)
- Šneperman, L. B.** See **Gluskin, L. M.**; et al., (56 #3168)
- Stralka, A. R.** See **Hofmann, Karl Heinrich**, (55 #213) and **Brown, D. R.**, (55 #3144)
- West, T. T.** See **Bertman, M. O.**, (55 #3143)
- Williams, W. Wiley** Semigroups with identity on Peano continua. (56 #3808)

## 22A20 Analysis on topological semigroups

- Baker, J. W.** Duality of semigroups and measure algebras. (55 #6115)
- Choy, Stephen T. L.** Hewitt-Zuckerman semigroups in the structure semigroups of measure algebras. (55 #13156)
- Maserick, P. H.** Moments of measures on convex bodies. (56 #12786)

## 22A25 Representations of general topological groups and semigroups

- Bilyeu, Russell G.** (*with* Lau, A. Y. W.) Representations into the hyperspace of a compact group. (55 #8242)
- Lamarin, W. F.** Pontryagin duality for products and coproducts of abelian  $k$ -groups. (56 #5773)
- Lau, A. Y. W.** See **Bilyeu, Russell G.**, (55 #8242)
- Prodanov, Ivan** Minimal compact representations of algebras. (Russian summary) (55 #422)
- Pym, J. S.** (*with* Vasudeva, H. L.) Right ideals in  $\beta S$  and its measure algebra. (55 #8243)
- Vasudeva, H. L.** See **Pym, J. S.**, (55 #8243)

## 22A30 Representations of other topological algebraic systems

- Lea, J. W., Jr.** Continuous lattices and compact Lawson semilattices. (55 #7864)

## 22A99 None of the above, but in this section

- Lavis, A.** Prolongement simulatné d'une famille d'endomorphismes partiels ouverts dans les groupes topologiques commutatifs. (English summary) (56 #5774)
- Milnes, Paul** (*with* Pym, J. S.) Counterexample in the theory of continuous functions on topological groups. (55 #13157)
- Plaumann, Peter** Automorphismengruppen diskreter Gruppen als topologische Gruppen. (56 #12167)
- Pym, J. S.** See **Milnes, Paul**, (55 #13157)
- Seda, A. K.** Haar measures for groupoids. (55 #629)
- Tonge, Andrew M.** Translation invariance, compact semigroups and injective coalgebras. (56 #15822)
- Watanabe, Tadashi** On the cahracterization of uniform movability for compact connected abelian groups. (Serbo-Croatian summary) (55 #9085)

## 22Bxx Locally compact abelian groups (LCA groups)

### 22B05 General properties and structure of LCA groups

- Brown, Ronald** (*with* Higgins, Philip J.; Morris, Sidney A.) Countable products and sums of lines and circles: their closed subgroups, quotients and duality properties. (56 #12168)
- Higgins, Philip J.** See **Brown, Ronald**; et al., (56 #12168)
- Khan, M. A.** A notion of purity in locally compact groups. (55 #5787)
- Morris, Sidney A.** ★Pontryagin duality and the structure of locally compact abelian groups. (56 #529)
- See also **Brown, Ronald**; et al., (56 #12168)
- Muhin, Ju. N.** The number of generating elements of a locally compact abelian group. (Russian) (56 #530)
- Otaki, Hiroshi** Remarks on characterization of locally compact abelian groups. (55 #10964)
- Venkataraman, Rangachari** Interval of group topologies satisfying Pontryagin duality. (56 #5775)

### 22B10 Structure of group algebras of LCA groups

### 22B99 None of the above, but in this section

- Brown, Lawrence G.** Locally compact abelian groups with trivial multiplier group. (55 #6122)

## 22C05 Compact groups

- Edwards, R. E.** ★Integration and harmonic analysis on compact groups. (56 #9183)
- Hackler, Donald** Compact groups of real power need not be metrizable. (56 #1271)
- Johnson, Russell A.** Representations of compact groups on topological vector spaces: some remarks. (55 #3151)

- Keesling, James** Some examples in shape theory using the theory of compact connected abelian topological groups. (55 #9084)
- Knill, Ronald J.** The Lefschetz fixed point theorem for compact groups. (56 #13204)
- Polec'kih, V. M.** Topological groups with a compactness condition for the classes of conjugate elements. (Russian) (56 #5776)
- Rindler, Harald** Uniformly distributed sequences in quotient groups. (55 #10601)
- Rosenblatt, Joseph Max** Uniform distribution in compact groups. (55 #2820)
- Totally-disconnected compact metric groups. (55 #560)
- Štern, A. I.** Dual objects of compact and discrete groups. (Russian. English summary) (56 #8748)

## 22Dxx Locally compact groups and their algebras

- Gaal, Steven A.** ★Linear analysis and representation theory. (56 #5777)

### 22D05 General properties and structure of locally compact groups

- Boseck, Helmut** (*with* Czichowski, G.) On the structure of connected locally compact groups. (55 #5788)
- Čarin, V. S.** A class of topological FC-groups. (Russian) (56 #15823)
- Czichowski, G.** See **Boseck, Helmut**, (55 #5788)
- Derighetti, Antoine** Sur la propriété  $P_1$ . (English summary) (55 #3680)
- Lee, Dong Hoon** On deformations of homomorphisms of locally compact groups. (55 #8244)
- Mocanu, Constanța** A certain invariant of H. Leptin. (Romanian. English summary) (55 #12861)
- Moskalenko, Z. Ī.** A condition for the finiteness of the rank of locally compact solvable groups. (Russian) (55 #5789)
- An estimate of the rank of connected locally compact nilpotent groups. (Russian) (56 #15829)
- Ng, Kai-Wang** Quasi-invariant measures in groups of second category. (55 #3152)
- Peterson, H. Leroy** Extensions of Haar measure to relatively large nonmeasurable subgroups. (55 #8686)
- Polec'kih, V. M.** Some properties of groups with an inductivity condition for subgroups. (Russian. English summary) (55 #561)
- Locally compact locally nilpotent groups with the inductivity condition for serving subgroups. (Russian) (55 #8245)
- Topological groups that are nearly groups of rank one. (Russian) (55 #5790)

### 22D10 Unitary representations of locally compact groups

- Arsac, Gilbert** Sur l'espace de Banach engendré par les coefficients d'une représentation unitaire. (56 #3180)
- Blackadar, Bruce E.** The regular representation of restricted direct product groups. (55 #12860)
- Bouvier, Anne-Marie** La formule de Plancherel pour les groupes localement compacts séparables. (English summary) (56 #3181)
- Carey, A. L.** Square-integrable representations of non-unimodular groups. (55 #3153)
- Eymard, Pierre** ★Moyennes invariantes et représentations unitaires. (56 #6279)
- Gelf'and, I. M.** See **Veršik, A. M.**; et al., (55 #10602)
- Gootman, Elliot C.** Weak containment and weak Frobenius reciprocity. (55 #8246)
- Graev, M. I.** See **Veršik, A. M.**; et al., (55 #10602)
- Guichardet, Alain** Some properties of the cohomology of topological groups. (56 #8747)
- Klimik, A. U.** The Fourier transform of functions on a group. (Russian) (55 #562)
- Mackey, George W.** Ergodicity in the theory of group representation. (55 #8247)
- Moran, William** Some results in the cohomology of topological groups. (55 #8248)
- Reiter, Hans** Sur le théorème de Weil-Cartier. (English summary) (55 #5535)
- Sally, Paul J., Jr.** Harmonic analysis and group representations. (56 #12169)
- Stewart, James** Positive definite functions and generalizations, an historical survey. (55 #3679)
- Veršik, A. M.** (*with* Gelf'and, I. M.; Graev, M. I.) Representations of the group of smooth mappings of a manifold  $X$  into a compact Lie group. (Russian) (55 #10602)

### 22D12 Other representations of locally compact groups

- Boseck, Helmut** Über Darstellungen lokal-kompakter topologischer Gruppen. (55 #563)
- Edamatsu, Takashi** A note on the definition of the complete irreducibility and the Naimark relatedness of representations of groups. (55 #564)
- Fontenot, Robert A.** (*with* Schochetman, I.) Induced representations of groups on Banach spaces. (56 #15824)
- Guichardet, Alain** Sur la cohomologie des groupes topologiques. III. (55 #5791)
- Jenkins, J. W.** Representations of exponentially bounded groups. (56 #12770)
- Johnson, Russell A.** Representations of compact groups on topological vector spaces: some remarks. (55 #3151)
- Litvinov, G. L.** Group algebras of analytic functionals, and their representations. (Russian) (56 #5778)
- Moore, Calvin C.** (*with* Repka, Joe) A reciprocity theorem for tensor products of group representations. (56 #8749)
- Naimark, M. A.** The condition for the decomposability of a homogeneous representation of a locally compact group into a direct Radon integral of its irreducible representations. I. The case of a cyclic representation. (Russian) (56 #531)
- Repka, Joe** See **Moore, Calvin C.**, (56 #8749)
- Schochetman, I.** See **Fontenot, Robert A.**, (56 #15824)

### 22D15 Group algebras of locally compact groups

- Mocanu, Constanța** A certain invariant of H. Leptin. (Romanian. English summary) (55 #12861)
- Poguntke, Detlev** Der Raum der primitiven Ideale von endlichen Erweiterungen lokal-kompakter Gruppen. (55 #12862)
- Rindler, Harald** Approximierende Einheiten in Idealen von Gruppenalgebren. (55 #565)



Rousseau, Ronny The left Hilbert algebra associated to a semi-direct product. (56 #16386)

## 22D20 Representations of group algebras

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26-04 Explicit machine computation and programs (not the theory of computation or programming)

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- 26A78 Polynomials (location of zeros) [See also 12D10, 30A08, 65H05.]
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- Goodman, A. W. Remarks on the Gauss-Lucas theorem in higher dimensional space. (**55** #8326)
- Koženikov, V. I. Some extremal problems for the zeros of polynomials and the eigenvalues of matrices. (Russian) **56** #15857
- Lorch, L. Some monotonicity properties of polynomials with equally spaced zeros. **56** #557
- Marden, Morris (with McCoy, Peter A.) Level sets of polynomials in  $n$  real variables. **56** #15858
- McCoy, Peter A. See Marden, Morris, **56** #15858
- 26A81 Rational functions
- 26A82 Inequalities for trigonometric functions and polynomials
- 26A84 Inequalities involving derivatives and differential and integral operators
- Chábek, Josef A generalization of the Markov inequality. (Czech. Russian summary) **55** #8279
- Chiti, Giuseppe Una maggiorazione a priori dal punto di vista variazionale. (English summary) **55** #3193
- Chui, Charles K. (with Smith, Philip W.) A note on Landau's problem for bounded intervals. **56** #15859
- Everitt, W. N. (with Jones, D. S.) On an integral inequality. **56** #8769
- Florkiewicz, B. (with Rybarski, A.) Some integral inequalities of Sturm-Liouville type. **56** #3219
- Freud, Geza Markov-Bernstein type inequalities in  $L_p(-\infty, \infty)$ . **55** #3194
- Gabusin, V. N. Inequalities between derivatives in the  $L_p$  metrics for  $0 < p < \infty$ . (Russian) (**55** #3777)
- Horgan, Cornelius O. (with Knowles, James K.) Eigenvalue problems associated with Korn's inequalities. (**55** #13920)
- Jones, D. S. See Everitt, W. N., **56** #8769
- Kirsanova, G. V. Inequalities between the moduli of functions and of their derivatives. (Russian) **56** #15860
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- Magaril-Il'jaev, G. G. Kolmogorov inequalities on the half-line. (Russian. English summary) **55** #10622
- Rybarski, A. See Florkiewicz, B., **56** #3219
- Schoenberg, I. J. The Landau problem for motions in a ring and in bounded continua. **55** #10623
- Simonenko, I. B. Some bounds for power quasipolynomials. (Russian) **56** #5816
- Smith, Philip W. See Chui, Charles K., **56** #15859
- Soljar, V. G. An inequality for the norms of a function and of its derivatives. (Russian) **56** #558
- 26A86 Inequalities for sums, series and integrals
- Aliev, R. M. Some integral inequalities. (Russian. Azerbaijani and English summaries) **56** #3220
- New integral inequalities, and their applications. (Russian. Azerbaijani and English summaries) (**56** #16097)
- Blum, Julius R. (with Reichaw, M.) Two integral inequalities. **56** #8770
- Bolmarcich, Joseph J. The behavior of the maximum value of finite sections of a class of bilinear forms. **55** #593
- Chong, Kong Ming On a spectral inequality. **55** #594
- A theorem for spectral inequalities. (**55** #3202)
- Copson, E. T. Some integral inequalities. **56** #559
- Diananda, P. H. On some inequalities related to Mathieu's. **56** #5817
- Dorđević, Radosav Ž. (with Milovanović, Gradimir V.) On some generalizations of Zmorović's inequality. **56** #560
- Dubuc, Serge Critères de convexité et inégalités intégrales. (English summary) (**56** #3210)
- Fink, A. M. (with Jodeit, Max, Jr.) A generalization of the arithmetic-geometric means inequality. **55** #595
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- Helton, Jon C. Two generalizations of the Gronwall inequality by product integration. **56** #8771
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- On a probability bound of Marshall and Olkin. (**56** #16930)
- Kabak, Bert See Schaumberger, Norman, **55** #3197
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- Kozjakin, V. S. The inverse Minkowski inequality for monotone functions. (Russian) **56** #561
- Leindler, L. On a certain converse of Hölder's inequality. **55** #3195
- Inequalities of Hardy-Littlewood type. (Russian summary) **55** #597
- Ligeża, Jan On an integral inequality. (Polish summary) **55** #5822
- Milovanović, Gradimir V. (with Pečarić, Josip E.) Some considerations on Iyengar's inequality and some related applications. **56** #5820
- See also Vasić, Petar M., **56** #5819 and Dorđević, Radosav Ž., **56** #560
- Milovanović, Igor See Vasić, Petar M., **56** #8773
- Mitrinović, Dragoslav S. (with Vasić, Petar M.) Addenda to: *Analytic inequalities* (Springer, New York, 1970) by D. S. Mitrinović. I. **56** #5818
- Nečaeв, I. D. Apropos of a certain inequality of S. F. Morozov. (Russian) **55** #3196
- Certain generalizations of a multidimensional inequality of Wirtinger type. I, II. (Russian) **55** #598
- Németh, József Generalizations of the Hardy-Littlewood inequality. II. **56** #8772
- Nurimov, T. Some certain two-dimensional integral inequalities. (Russian) **56** #3221
- Oberschelp, Walter Ein neuer elementarer Beweis für die Ungleichung zwischen dem arithmetischen und dem geometrischen Mittel. **56** #3222
- Pachpatte, B. G. On some integral inequalities of the Gronwall-Bellman type. (**56** #12374)
- On some fundamental integral inequalities of the Bellman-Bihari type. (**56** #12375)
- Pavlov, E. A. A generalization of the Hardy inequality. (Russian) **56** #12200
- Pečarić, Josip E. See Milovanović, Gradimir V., **56** #5820
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- Reichaw, M. See Blum, Julius R., **56** #8770
- Rešetnjak, Ju. G. See Gurov, L. G., **55** #596
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- Sysoeva, F. A. An inequality of Hardy-Littlewood type for a product of functions. (Russian) **55** #10625
- Tomilenko, V. A. On a property of strictly logarithmic concave functions. **55** #3198
- The integrals of logarithmically concave functions. (Russian) (**55** #10618)
- Tong, Y. L. An ordering theorem for conditionally independent and identically distributed random variables. (**55** #6636)
- Tudor, Gheorghe M. Some remarkable integral inequalities. **55** #12885
- Vasić, Petar M. (with Milovanović, Gradimir V.) On an inequality of Iyengar. **56** #5819
- (with Milovanović, Igor) On the ratio of means. **56** #8773
- See also Mitrinović, Dragoslav S., **56** #5818
- Vollman, Thomas E. Inequalities for integral bilinear forms with applications to mechanical systems. **56** #5821
- Zolin, A. F. Some generalizations of two classical inequalities, and an application. (Russian) **55** #5823
- Zorio Blanco, Valeriano Inequalities. (Spanish) **55** #12886
- 26A87 Other analytical inequalities
- Brascamp, Herm Jan (with Lieb, Elliott H.) On extensions of the Brunn-Minkowski and Prékopa-Leindler theorems, including inequalities for log concave functions, and with an application to the diffusion equation. **56** #8774
- Chong, Kong Ming The invariance properties of spectral inequalities under convex transformations. **56** #12201



- Heinig, H. P. Weighted maximal inequalities for  $\ell^p$ -valued functions. **56** #3223  
 Lacković, Ivan B. See Vasić, Petar M., **55** #10626  
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 Shafer, Robert E. Analytic inequalities obtained by quadratic approximation. **56** #12203  
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 Vasić, Petar M. (with Lacković, Ivan B.) Some complements to the paper: "On an inequality for convex functions" (Univ. Beograd. Publ. Elektrotech. Fak. Ser. Mat. Fiz. No. 461-497 (1974), 63-66). **55** #10626

## 26A90 Real-analytic functions

- Tougeron, Jean Claude Solutions d'un système d'équations analytiques réelles et applications. (English summary) (**55** #5888)

26A93  $C^\infty$ -functions, quasi-analytic functions

- Christensen, Niels M. Zur Łojasiewicz-Ungleichung für differenzierbare Funktionen. (English summary) (**55** #9150)  
 González de Buitrago Díaz, Gonzalo A note on the mean value theorem for a certain class of functions. (Spanish) **56** #15861  
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 Milman, P. On the nonexistence of a projection from functions of  $x$  to functions of  $x^n$ . (**55** #13474)  
 Mostowski, Tadeusz A decomposition theorem for  $C^\infty$ -functions. (Russian summary) **55** #12889  
 Tougeron, Jean Claude  $\star$ Ideaux de fonctions différentiables. (**55** #13472)

## 26A96 Calculus of functions on infinite-dimensional spaces

## 26A97 Nonarchimedean analysis

## 26A98 Nonstandard analysis [See also 02H25.]

- Capiński, Marek Ultraproducts of higher-order models and non-standard analysis. (**56** #116)  
 Jha, S. N. A non-standard treatment of some aspects of two variables function theory. **56** #8776  
 Loeb, Peter A. Applications of nonstandard analysis to ideal boundaries in potential theory. (**56** #15961)  
 Winkler, Regine Über mögliche Erweiterungen der Analysis und ihre praktische Bedeutung. (**55** #5439)

## 28-XX MEASURE AND INTEGRATION [For analysis on manifolds, see 58-XX.]

## 28-01 Elementary exposition (collegiate level)

- Ash, Robert B.  $\star$ Real analysis and probability. **55** #8280  
 $\star$ Measure, integration, and functional analysis. **55** #8281  
 Brehmer, Siegfried  $\star$ Einführung in die Masstheorie. **56** #8777  
 Burrill, Claude W.  $\star$ Measure, integration, and probability. **56** #15862  
 Descombes, Roger  $\star$ Intégration. **55** #12890  
 De Wilde, M. See Garnir, H. G.; et al., **56** #562  
 Fomin, S. V. See Kolmogorov, A. N., (**55** #8728)  
 Garnir, H. G. (with De Wilde, M.; Schmets, J.)  $\star$ Analyse fonctionnelle. Tome II. Mesure et intégration dans l'espace euclidien  $E_n$ . **56** #562  
 (Helle, Renate) See Smirnov, V. I., (**55** #5807)  
 (Knopp, Konrad) See Lösch, Friedrich, (**56** #8250)  
 Kolmogorov, A. N. (with Fomin, S. V.)  $\star$ Элементы теории функций и функционального анализа. (Russian) [Elements of the theory of functions and functional analysis] (**55** #8728)  
 Lösch, Friedrich  $\star$ Einführung in die höhere Mathematik für Studierende und zum Selbststudium (von H. von Mangoldt und K. Knopp). Band IV. (**56** #8250)  
 (Mai, Brigitte) See Smirnov, V. I., (**55** #5807)  
 (von Mangoldt, H.) See Lösch, Friedrich, (**56** #8250)  
 Phillips, Esther R.  $\star$ An introduction to analysis and integration theory. **55** #8282  
 Schmets, J. See Garnir, H. G.; et al., **56** #562  
 Smirnov, V. I.  $\star$ Lehrgang der höheren Mathematik, Teil V. (**55** #5807)  
 Temple, G.  $\star$ The structure of Lebesgue integration theory. **55** #8283

## 28-02 Advanced exposition (research surveys, etc.)

## 28-03 Historical

## 28-04 Explicit machine computation and programs (not the theory of computation or programming)

## 28-06 Collections of papers; proceedings of conferences

- (Bellow, Alexandra) See Measure theory, **55** #8284 and Measure theory, **55** #8285  
 (Kólcow, Dietrich) See Measure theory, **55** #8284 and Measure theory, **55** #8285

## Conference:

- Measure Theory See Measure theory, **55** #8284 and Measure theory, **55** #8285  
 Measure theory  $\star$ Measure theory. **55** #8284  
 $\star$ Measure theory. **55** #8285

28A05 Classes of sets (Borel fields,  $\sigma$ -rings, etc.), measurable sets, Suslin sets, analytic sets [See also 04A15, 26A21, 54H05.]

- Ascherl, Albert (with Lehn, Jürgen) Two principles for extending probability measures. (**56** #12204)  
 Broughton, Allen (with Huff, Barthel W.) A comment on unions of sigma-fields. **56** #8778  
 Brown, Jack B. Baire category in spaces of probability measures. **56** #3224  
 Dellacherie, Claude Compléments aux exposés sur les ensembles analytiques et les temps d'arrêt. (**55** #12524)  
 Frič, Roman On continuous characters of Borel sets. (**55** #10597)  
 Harazišvili, A. B. Certain properties of uniform subsets of the Euclidean plane. (Russian) (**56** #15886)  
 Huff, Barthel W. See Broughton, Allen, **56** #8778  
 Humke, Paul D. Baire category and disjoint rectilinear accessibility. **56** #563  
 Lehn, Jürgen (with Mägerl, Gerhard) On the uniqueness of pre-image measures. **56** #564  
 See also Ascherl, Albert, (**56** #12204)  
 Louveau, Alain Boréliens à coupes  $K_{\sigma\delta}$ . (English summary) (**56** #131)  
 Mägerl, Gerhard See Lehn, Jürgen, **56** #564  
 Maharam, D. Category, Boolean algebras and measure. (**56** #15869)  
 Morgan, John C., II Baire category from an abstract viewpoint. (**55** #6392)  
 Ridder, J. Dualität bei Suslinschen Mengen; Anwendung in Theorie von äußeren und inneren Kapazitäten. **56** #15863  
 Zaharopol, Radu Quelques observations sur les ensembles analytiques. **56** #565  
 Séminaire:  
 Probabilités See Dellacherie, Claude, (**55** #12524)

## 28A10 Real- or complex-valued set functions, contents, measures, outer measures, capacities, etc.

- Adamski, Wolfgang Capacitylike set functions and upper envelopes of measures. **56** #3225  
 Alsynbaev, K. (with Imomnazarov, B.; Rubinštejn, G. Š.) The mass transfer problem on a compactum with a nonsymmetric metric. (Russian) **56** #3226  
 Appling, William D. L. Continuity and the subdivision norm infimum function. **55** #600  
 Ascherl, Albert (with Lehn, Jürgen) Two principles for extending probability measures. **56** #12204  
 Aumann, Robert J. (with Rothblum, Uriel G.) Orderable set functions and continuity. III. Orderability and absolute continuity. **55** #8288  
 Bachman, George (with Sultan, Alan) Extensions of regular lattice measures with topological applications. **55** #601  
 Banerjee, C. R. On series with positive terms and some properties of atomic measures. **55** #5824  
 Bell, Wayne C. A decomposition of additive set functions. **56** #12205  
 Bertin, Emile M. J. Limites projectives dans une catégorie d'espaces probabilisés et de correspondances mesurables. (English summary) **55** #602  
 Bharucha-Reid, A. T. See Christensen, Mark J., **56** #566  
 Brooks, James K. (with Reichelderfer, Paul V.) A Jordan decomposition for weight functions. **55** #8286  
 Christensen, Jens Peter Reus Submeasures and the problem on the existence of control measures. (**56** #5831)  
 Christensen, Mark J. (with Bharucha-Reid, A. T.) Algebraic models for probability measures associated with solutions of random equations. I. **56** #566  
 Eisele, K.-Th. On the uniqueness of preimages of measures. **56** #15864  
 Eršov, M. P. Extensions of measures. Stochastic equations. (**56** #6812)  
 On stochastic equations. (**56** #6813)  
 Non-anticipating solutions of stochastic equations. (**56** #6814)  
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 Friedman, Harvey A definable nonseparable invariant extension of Lebesgue measure. (**56** #2830)  
 Garnett, John  $\star$ Analytic capacity and measure. (**56** #12257)  
 Halevy, Avner See Rao, M. Bhaskara, **56** #12207  
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 Meyers, Philip R. A minimax-measure intersection problem. **56** #8779  
 Musiał, Kazimierz Inheritness of compactness and perfectness of measures by thick subsets. **56** #567  
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 Pacquement, Antoine Détermination d'une fonction par sa dérivée sur un réseau binaire. (English summary) **55** #3199  
 Pelling, M. J. The inequality  $m^*(f+g)(H) \leq m^*f(H) + m^*g(H)$ . **56** #5822  
 Rao, M. Bhaskara (with Halevy, Avner) On Leader's  $V_p$  space of finitely additive measures. **56** #12207  
 Reichelderfer, Paul V. See Brooks, James K., **55** #8286  
 Ridder, J. Spezielle Beispiele für äußere und innere Kapazitäten (im Sinne von Choquet). (**55** #10709)  
 Dualität bei Suslinschen Mengen; Anwendung in Theorie von äußeren und inneren Kapazitäten. (**56** #15863)  
 Rothblum, Uriel G. Orderable set functions and continuity. II. Set functions with infinitely many null points. **55** #8287  
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- Sultan, Alan See Bachman, George, 55 #601  
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 Wolf, Guus ★Obere und untere Wahrscheinlichkeiten. 56 #8780

## 28A15 Abstract differentiation theory, differentiation of set functions [See also 26A24.]

- (Córdoba, Antonio) See de Guzmán, Miguel, 56 #15866  
 Costinescu, O. (with Polexe, R.) On the differentiation of set functions with respect to a Hausdorff measure. (Romanian. French summary) 56 #3227  
 (Fefferman, R.) See de Guzmán, Miguel, 56 #15866  
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 de Guzmán, Miguel ★Differentiation of integrals in  $R^n$ . 56 #15866  
 Harazišvili, A. B. Differentiation with respect to Vitali systems. (Russian. Georgian and English summaries) 55 #606  
 Hayes, C. A. Derivation of the integrals of  $L^{(q)}$ -functions (55 #584)  
 Necessary and sufficient conditions for the derivation of integrals of  $L_q$ -functions. (55 #585)  
 Klimkin, V. M. Certain tests for absolute equicontinuity of a family of masses. (Russian) (56 #5827)  
 Marcus, Moshe (with Mizel, Victor J.) A Radon-Nikodým type theorem for functionals. 55 #607  
 McMin, Trevor J. Commuting and topological densities and liftings. 55 #5825  
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 Peral Alonso, Irene A general result on the equivalence between derivation of integrals and weak inequalities for the Hardy-Littlewood maximal operator. 55 #608  
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 Volčič, Alessio Sulla differenziazione di misure. (English summary) 55 #3200

## 28A20 Measurable and nonmeasurable functions, sequences of measurable functions, modes of convergence

- Berežnoi, E. I. Differentiable mappings in finite-dimensional spaces. (Russian) (56 #16666)  
 Brown, Lawrence D. (with Purves, R.) Measurable selections of extrema. 55 #5826  
 Bucchioni, Daniele (with Goldman, André) Sur la convergence presque partout des suites de fonctions mesurables. (English summary) 55 #609  
 Delode, Claude Champs mesurables d'espaces sousliniens. (English summary) 56 #3228  
 Foran, James On functions whose graph is of linear measure 0 on sets of measure 0. (56 #3204)  
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 Joó, István A remark on convergence systems in measure. 55 #8289  
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 Kocela, Edward Semi-uniform convergence of a sequence of functions. (55 #6052)  
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## 28A25 Integration with respect to measures and other set functions

- Areškin, G. Ja. (with Popov, V. A.)  $\Delta$ -functionals and an integral with respect to a continuous outer measure. (Russian) 56 #569  
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 Chaffield, J. A. Product integrals and continuity. (55 #5817)  
 Chițescu, Ion The conjugate space of the space of measures. (55 #3771)  
 Chong, Kong Ming A theorem for spectral inequalities. 55 #3202  
 Efremova, I. P. On the question of the interrelations of the fundamental theorems of measure theory. (Russian) 55 #3203

- Huggins, Frank N. On the equivalence of certain integrals. 55 #8291  
 Klimkin, V. M. Certain tests for absolute equicontinuity of a family of masses. (Russian) 56 #5827  
 Kotkowski, Bogdan (with Stypiński, Zenon) A method of introduction of Lebesgue integral. 56 #12209  
 Ney, Paul Un schéma unitaire pour le traitement de divers opérateurs remarquables de l'analyse. (55 #589)  
 Popov, V. A. See Areškin, G. Ja., 56 #569  
 Puglisi, Mario A. Un punto di vista assiomatico della teoria dell'integrazione di funzioni vettoriali rispetto ad una misura vettoriale. (English summary) 56 #3229  
 Richter, Wolf-Dieter Über eine Verallgemeinerung des Stieltjesschen Integralbegriffes für Funktionen mehrerer Veränderlicher. (55 #8276)  
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 Stypiński, Zenon See Kotkowski, Bogdan, 56 #12209

## 28A30 Integration theory via linear functionals (Radon measures, Daniell integrals, etc.)

- Becker, Richard Sur l'intégrale de Daniell. (English summary) 56 #15867  
 Cicogna, G. Un nuovo approccio alla teoria dell'integrazione reale. (English summary) 55 #12891  
 Sulle misure di Daniell fra spazi di Riesz. (English summary) (55 #6169)  
 Dubins, Lester E. On everywhere-defined integrals. 56 #8783  
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- Ishitani, Hiroshi The central limit theorem for piecewise linear transformations. (**56** #9642)
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- Katok, A. B. (with Sataev, E. A.) Standardness of rearrangement automorphisms of segments and flows on surfaces. (Russian) **55** #3217
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- See also* Zemljakov, A. N., **55** #5842
- Keane, Michael Non-ergodic interval exchange transformations. **55** #8313
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- (with Smorodinsky, Meir) Ergodic flows of positive entropy can be time changed to become  $K$ -flows. **56** #5837
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- See also* Hamachi, Toshihiro; et al., **55** #5839
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- (with Meyer, Paul André) Questions de théorie des flots. II. Mesures de Palm, théorème d'Ambrose-Kakutani. (**55** #1427)
- (with Meyer, Paul André) Questions de théorie des flots. III. Exemples de  $K$ -flots. (**55** #1428)
- (with Meyer, Paul André) Questions de théorie des flots. IV. Hélices croissantes et mesures de Palm. (**55** #1429)
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- Veech, William A. Unique ergodicity of horospherical flows. (**56** #5788)
- Vershik, A. M. Letter to the editors: Addendum to "Application of ergodic theory to probability theory" (Uspehi Mat. Nauk **30** (1975), no. 3(183), 125–146) by D. S. Ornstein. (Russian) **56** #3256
- Vinokurov, V. G. (with Ganihodžev, N. N.) Nonmeasurable partitions of a Lebesgue space. (Russian) **55** #627
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- Zemljakov, A. N. (with Katok, A. B.) Letter to the editors: "Topological transitivity of billiards in polygons" (Mat. Zametki **18** (1975), no. 2, 291–300). (Russian) **55** #5842
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- Normal ergodic actions. **56** #5841
- Compactness conditions on cocycles of ergodic transformation groups. **55** #8320
- Global analysis and its applications *See* Sigmund, Karl, **55** #8318
- Probability *See* Séminaire: Probabilités, I, **56** #12234
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- Whittemore Lectures in Mathematics *See* Ornstein, Donald S., **56** #5836

28A70 Invariant measures, Haar measure [See also 43A05.]

Dobrušin, R. L. (with Minlos, R. A.) Factor measures on measurable spaces. (Russian) **55** #5843

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Harazišvili, A. B. Extensions of invariant measures. (Russian, Georgian and English summaries) **56** #15885

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- Kahnert, D.** Haar-Mass und Hausdorff-Mass. **56** #8817  
**Kuczma, Marcin E.** A generalization of Steinhaus' theorem to coordinatewise measure preserving binary transformations. **55** #12898  
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**Seda, A. K.** Haar measures for groupoids. **55** #629

28A75 Length, area, volume, other geometric measure theory [See also 26A63, 49F20.]

- Averna, Alfonso** (with Lodovici, Carla) La "quasi sub-additività" rispetto a una coppia  $(\mathfrak{P}, \mathfrak{Q})$  di famiglie di sistemi finiti e alla mesh  $\delta$ . (English summary) **56** #5842  
**Breckenridge, J. C.** See **Nishiura, Togo**, **55** #8323  
**Federer, Herbert** (with Ziemer, William P.) The Lebesgue set of a function whose distribution derivatives are  $p$ -th power summable. **55** #8321  
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Hausdorff measure functions in the space of compact subsets of the unit interval. **55** #631  
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**Oleksiv, I. Ja.** (with Pesin, I. N.) Three problems on minimal isotopies and on the approximation of curves and surfaces by homeomorphisms. (Russian) **56** #15887  
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**Stachó, L. L.** On the volume function of parallel sets. **56** #588  
**Topsoe, Flemming** Packings and coverings with balls in finite dimensional normed spaces. (**56** #15865)  
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28A99 None of the above, but in this section

### 30–XX FUNCTIONS OF A COMPLEX VARIABLE [For analysis on manifolds, see 58–XX.]

- Bank, Steven B.** (with Kaufman, Robert P.) On meromorphic solutions of first-order differential equations. (**55** #3375)  
**Fuhrmann, Paul A.** On Hankel operator ranges, meromorphic pseudo-continuations and factorization of operator-valued analytic functions. (**55** #1128)  
**Kaufman, Robert P.** See **Bank, Steven B.**, (**55** #3375)

30–01 Elementary exposition (collegiate level)

- Aramanovič, I. G.** See **Volkovyskii, L. I.**; et al., **56** #3259  
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**Laitone, E. V.** Relation of the conjugate harmonic functions to  $f(z)$ . **55** #10646  
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**(Shiffer, Victor)** See **Volkovyskii, L. I.**; et al., **56** #3259  
**(Silverman, Richard A.)** See **Markušević, A. I.**, **56** #3258  
**Smirnov, V. I.** ★Lehrgang der höheren Mathematik. Teil III, 2. (**55** #12382)  
**Srinivasan, V. K.** A note on harmonic functions and harmonic conjugates. **56** #15890  
**Volkovyskii, L. I.** (with Lunc, G. L.; Aramanovič, I. G.) ★Problems in the theory of functions of a complex variable. **56** #3259

30–02 Advanced exposition (research surveys, etc.)

- Anderson, J. M.** (with Barth, K. F.; Brannan, D. A.) Research problems in complex analysis. **55** #12899  
**Barth, K. F.** See **Anderson, J. M.**; et al., **55** #12899  
**Brannan, D. A.** See **Anderson, J. M.**; et al., **55** #12899  
**Henrici, Peter** ★Applied and computational complex analysis. Vol. 2. **56** #12235  
**Mackey, George W.** ★Lectures on the theory of functions of a complex variable. **55** #10647  
**Markušević, A. I.** ★Избранные главы теории аналитических функций. (Russian) [Selected chapters in the theory of analytic functions] **55** #8324

30–03 Historical

- Aleksandrov, P. S.** (with Bicadze, A. V.; Višik, M. I.; Oleinik, O. A.) Il'ja Nestorovič Vekua (on the occasion of his seventieth birthday). (Russian) (**56** #8299)  
**Bicadze, A. V.** See **Aleksandrov, P. S.**; et al., (**56** #8299)  
**Oleinik, O. A.** See **Aleksandrov, P. S.**; et al., (**56** #8299)  
**(Vekua, I. N.)** See **Aleksandrov, P. S.**; et al., (**56** #8299)  
**Višik, M. I.** See **Aleksandrov, P. S.**; et al., (**56** #8299)  
**Bibliography:**  
**Vekua, I. N.** See **Aleksandrov, P. S.**; et al., (**56** #8299)  
**Birthday:**  
**Vekua, I. N.** See **Aleksandrov, P. S.**; et al., (**56** #8299)

30–04 Explicit machine computation and programs (not the theory of computation or programming)

30–06 Collections of papers; proceedings of conferences

- (Buckholtz, J. D.)** See **Complex analysis**, **56** #3260  
**(Gamkrelidze, R. R.)** See **Current problems in mathematics**, (**56** #649)  
**(Hvedelidze, B. V.)** See **Collection: Theory of functions**, **55** #10648  
**(Mitjagin, B. S.)** See **Mathematical programming and related questions**, (**55** #16)  
**(Mushelišvili, N. I.)** See **Collection: Theory of functions**, **55** #10648  
**(Shah, Swarupchand M.)** See **Complex analysis**, **56** #3260  
**(Suffridge, T. J.)** See **Complex analysis**, **56** #3260  
**Collection:**  
**Theory of functions** ★Сборник работ по теории функций. Вып. 7. (Russian) [Collection of articles on the theory of functions. Vol. 7] **55** #10648  
**Complex analysis** ★Complex analysis. **56** #3260  
**Conference:**  
**Complex Analysis** See **Complex analysis**, **56** #3260  
**Current problems in mathematics** ★Современные проблемы математики. Том 4. (Russian) [Current problems in mathematics. Vol. 4] (**56** #649)  
**Functional analysis** See **Mathematical programming and related questions**, (**55** #16)  
**Itogi Nauki i Tehniki** See **Current problems in mathematics**, (**56** #649)  
**Lexington, Ky.** See **Complex analysis**, **56** #3260  
**Mathematical programming and related questions** ★Математическое программирование и смежные вопросы (Труды седьмой зимней школы, Дрогобыч, 1974). (Russian) [Mathematical programming and related questions (Proceedings of the Seventh Winter School, Droboych, 1974)] (**55** #16)  
**Proceedings:**  
**Winter School on Mathematical Programming and Related Questions** See **Mathematical programming and related questions**, (**55** #16)  
**Theory of functions** See **Mathematical programming and related questions**, (**55** #16)  
**and Collection: Theory of functions**, **55** #10648  
**Winter School:**  
**Mathematical Programming and Related Questions** See **Mathematical programming and related questions**, (**55** #16)

30A02 Monogenic properties of complex functions (including polygenic and areolar monogenic functions)

30A04 Inequalities in the complex domain

30A06 Polynomials

- Brannan, D. A.** (with Brickman, Louis) Coefficient regions for starlike polynomials. (Polish and Russian summaries) **56** #8819  
**Brickman, Louis** See **Brannan, D. A.**, **56** #8819  
**Fait, Maria** (with Stankiewicz, Jan; Zygmunt, Jadwiga) On some classes of polynomials. (Polish and Russian summaries) **56** #12236  
**Kirijackis, E.** An extremal problem in Euclidean space. (Russian. Lithuanian and English summaries) **56** #8820  
**Linden, C. N.** The modulus of polynomials with zeros on the unit circle. **55** #10649  
**Nguyen Thanh Van** Familles de polynômes ponctuellement bornées. **55** #632  
**Quine, J. R.** The geometry of  $p(S^1)$ . **56** #589  
**Rassias, G. M.** (with Rassias, J. M.; Rassias, Themistocles M.) A counterexample to a conjecture by P. Erdős. **56** #15891  
**Rassias, J. M.** See **Rassias, G. M.**; et al., **56** #15891  
**Rassias, Themistocles M.** See **Rassias, G. M.**; et al., **56** #15891  
**Stankiewicz, Jan** See **Fait, Maria**; et al., **56** #12236  
**Voorhoeve, Marc** On the oscillation of exponential polynomials. **55** #3224  
**Zygmunt, Jadwiga** See **Fait, Maria**; et al., **56** #12236

30A08 Zeros of polynomials, rational functions, and other analytic functions (e.g. zeros of functions with bounded Dirichlet integral) [For algebraic theory, see 12D10; for real methods, see 26A78.]

- Alam, Mahfooz** See **Zaheer, Neyamat**, **55** #8327  
**Anderson, B. D. O.** (with Jury, Eliahu I.; Chaparro, F. L. C.) Relations between real and complex polynomials for stability and aperiodicity conditions. **55** #633  
**Borwein, David** (with Kratz, W.) On the zeros of the power series  $\sum_{n=0}^{\infty} (-1)^n (1 - c^{-n-1})^k z^n$  with an application to discontinuous Riesz-summability. **56** #3261  
**Bustoz, J.** On the zeros of certain Jacobi polynomial sums. (**55** #5922)  
**Chaparro, F. L. C.** See **Anderson, B. D. O.**; et al., **55** #633  
**Diaz, J. B.** (with Shaffer, Dorothy Browne) A generalization, to higher dimensions, of a theorem of Lucas concerning the zeros of the derivative of a polynomial of one complex variable. **55** #8325  
**Džrbašjan, A. Ė.** Zeros of subclasses of analytic functions with a finite Dirichlet integral.



- (Russian. Armenian and English summaries) (56 #5893)  
**Goodman, A. W.** Remarks on the Gauss-Lucas theorem in higher dimensional space. 55 #8326  
**Jury, Eliahu I.** See **Anderson, B. D. O.**; et al., 55 #633  
**Kostova, M.** On functions of class  $E$ . II. (Bulgarian. Russian and German summaries) 56 #5845  
**Koženikov, V. I.** Some extremal problems for the zeros of polynomials and the eigenvalues of matrices. (Russian) (56 #15857)  
**Kratz, W.** See **Borwein, David**, 56 #3261  
**Leblanc, Raymond** Representation of a certain class of polynomials. 55 #3225  
**Marden, Morris** (with McCoy, Peter A.) Level sets of polynomials in  $n$  real variables. (56 #15858)  
**McCoy, Peter A.** See **Marden, Morris**, (56 #15858)  
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**Montgomery, Hugh L.** Polynomials in many variables. (56 #11974)  
**Pinkert, James R.** An exact method for finding the roots of a complex polynomial. (56 #299)  
**Pólya, George** On the zeros of successive derivatives—an example. 56 #5847  
**Quine, J. R.** On positively turning immersions. (55 #4212)  
**Saff, E. B.** (with Varga, Richard S.) On the sharpness of theorems concerning zero-free regions for certain sequences of polynomials. 56 #5848a  
 (with Varga, Richard S.) Erratum: "On the sharpness of theorems concerning zero-free regions for certain sequences of polynomials" (Numer. Math. 26 (1976), no. 4, 345–354). 56 #5848b  
**Shaffer, Dorothy Browne** See **Diaz, J. B.**, 55 #8325  
**Simeunović, D. M.** Sur une évaluation des valeurs approximatives des zéros complexes des polynômes. 55 #5845  
**Smith, Russell A.** Inclusion conditions for Hurwitzian and Schur sets in  $\mathbb{C}^{n+1}$ . 56 #15892  
**Stegbuchner, Johann** Nullstellen analytischer Funktionen und verallgemeinerte Carleson-Mengen. II. Nullstellen aus dem Innern der Kreisscheibe  $D$ . 56 #3262  
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**Varga, Richard S.** See **Saff, E. B.**, 56 #5848a and **Saff, E. B.**, 56 #5848b  
**Voorhoeve, Marc** ★Zeros of exponential polynomials. (Dutch summary) 56 #3263  
**Zaheer, Neyamat** On composite abstract homogeneous polynomials. (55 #2857)  
 (with Alam, Mahfooz) On the zeros of Stieltjes and Van Vleck polynomials. 55 #8327
- 30A10** Power series (including lacunary series)  
**Ahundov, R. R.** See **Mahmudov, A. S.**, (55 #975)  
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#### 31A35 Connections with differential equations

- Koval'ov, V. F. A generalization of harmonic functions. (Russian. English summary) 56 #12289  
 Lahtinen, Aatos On  $P$ -solvable functions for  $\Delta u = Pu$  on open Riemann surfaces. 56 #8876  
 Simonenko, I. B. More on the Trefftz method. (Russian) 55 #9572

#### 31A99 None of the above, but in this section

### 31Bxx Higher dimensional theory

- Schwall, Erhard ★Eine numerische Theorie zur Kollokationsmethode für die Integralgleichungen der Potentialtheorie des  $R^3$  im Falle einer torusartigen Fläche. (56 #1758)

#### 31B05 Harmonic, subharmonic, superharmonic functions

- Armitage, D. H. Uniqueness theorems for harmonic functions in domains of revolution. 55 #10707  
 Belov, I. S. Subharmonicity of the powers of the modulus of the gradient of a harmonic function. (Russian) 55 #3279  
 Bonami, A. A. (with Sokolova, O. A.) Hardy-Littlewood inequalities for periodic conjugate harmonic functions of several variables. (Russian) (55 #3663)  
 Brawn, F. T. Note on hyperplane mean values of positive subharmonic functions. 55 #10708  
 Chung, Lung Ock A simple proof about positive harmonic functions on  $R^n$ . 55 #12933  
 Džafarli, G. A. A uniqueness theorem of Phragmén-Lindelöf type for harmonic functions of three variables in a cylinder. (Russian. Azerbaijani summary) 55 #8384  
 (Egorov, Ju. V.) *See* Lewy, H., 55 #8385  
 Essén, Matts (with Shea, Daniel F.) Applications of Denjoy integral inequalities to growth problems for subharmonic and meromorphic functions. 56 #8877  
 Foht, O. S. An integral estimate of the derivatives of a harmonic function of an  $N$ -dimensional region in the  $L_p$  metric, and some applications of it. (Russian) 56 #5912  
 Fryant, Allan J. Growth and complete sequences of generalized axisymmetric potentials. 56 #5913  
 Gurov, S. V. Nonisomorphism of spaces of harmonic functions of a different number of variables. (Russian. English summary) (56 #6352)  
 Janušauskas, A. I. The coefficients of harmonic functions that are positive in the unit ball. (Russian) 55 #12934  
   Axially symmetric Laplace series. (Russian) 56 #5914  
 Kapanadze, Dž. V.  $\alpha$ -harmonic functions and their removable singularities. (Russian) 56 #15957



- Kowata, Atsutaka (with Okamoto, Kiyosato) Harmonic functions and the Borel-Weil theorem. (56 #16000)  
 Lewy, H. Generalization of a spatial angle theorem. (Russian) 55 #8385  
 McCoy, Peter A. Extremal properties of real axially symmetric harmonic functions in  $E^3$ . 56 #15958  
 Nguyen Thanh Van Bases communes pour certains espaces de fonctions harmoniques. (55 #8772)  
 Okamoto, Kiyosato See Kowata, Atsutaka, (56 #16000)  
 Rao, N. V. (with Shea, Daniel F.) Growth problems for subharmonic functions of finite order in space. 56 #3319  
 Shea, Daniel F. See Essén, Matts, 56 #8877 and Rao, N. V., 56 #3319  
 Sokolova, O. A. See Bonami, A. A., (55 #3663)  
 Topurija, S. B. The local boundary properties of harmonic functions in a ball. (Russian) 55 #8386  
 Ždanov, M. S. Development of the theory of the analytic continuation of potential fields in curvilinear three-dimensional domains. (Russian) 56 #12290

### 31B10 Integral representations

- Armitage, D. H. The Neumann problem for a function harmonic in  $\mathbb{R}^n \times (0, \infty)$ . 55 #687  
 Flandrin, Evelyne Détermination explicite de noyaux de Hunt sur  $\mathbb{R}^n$ . (English summary) 56 #642  
 Kolaski, Clinton, An F. and M. Riesz type theorem for the unit ball in complex  $N$ -space. (56 #658)

### 31B15 Potentials and capacities, extremal length

- Choquet, Gustave Convergence vague et suites de potentiels newtoniens. 55 #3280  
 Kalina, Jerzy A variational characterization of the capacity in 3-space. (Polish summary) 55 #8387  
 Mizuta, Yoshihiro On the existence of boundary values of Beppo Levi functions defined in the upper half space of  $\mathbb{R}^n$ . 56 #8878  
 Waldvogel, Jörg The Newtonian potential of a homogeneous cube. (German summary) 56 #643  
 Ziemer, William P. Some remarks on harmonic measure in space. 55 #688

### 31B20 Boundary value and inverse problems

- Anger, G. Beziehungen zwischen Potentialtheorie und Geophysik. (56 #10737)  
 (with Schulze, Bert-Wolfgang) Einige Bemerkungen über harmonische Masse und inverse Probleme. 56 #5915  
 Armitage, D. H. A strong type of regularity for the PWB solution of the Dirichlet problem. 55 #689  
 Barański, Feliks (with Musiałek, Jan) On mixed boundary-value problems for a spherical octant. 56 #644  
 Dont, Miroslav Non-tangential limits of the double layer potentials. 56 #3320  
 Gogolauri, L. A. Boundary value problems for a generalized potential vector. (Russian. Georgian and English summaries) 55 #690  
 González, R. (with Kress, R.) On the treatment of a Dirichlet-Neumann mixed boundary value problem for harmonic functions by an integral equation method. 55 #12935  
 Kekelija, M. M. A certain nonlinear boundary value problem. (Georgian. Russian summary) 56 #8879  
 Kölbl, Klaus Eine inverse Aufgabe für biharmonische Potentiale. 55 #691  
 Kraja, O. On discontinuous solutions of the Dirichlet problem for a second order equation. (Albanian. French summary) 56 #5916  
 Kress, R. See González, R., 55 #12935  
 Maz'ja, V. G. The connection between Martin's and Euclid's topologies. (Russian) 56 #12291  
 Musiałek, Jan See Barański, Feliks, 56 #644  
 Nayar, B. M. Mixed boundary value problem in three dimensions. 56 #5917  
 Pokorná, Eva Harmonic functions on convex sets and single layer potentials. (Loose Russian summary) 56 #3321  
 Saak, E. M. The stability of the Dirichlet and Neumann problems. (Russian) 56 #8880  
 Schulze, Bert-Wolfgang See Anger, G., 56 #5915

### 31B25 Boundary behavior

- Armitage, D. H. On harmonic polynomials. 55 #692  
 Kostense, P. J. On the behaviour of minimal positive harmonic functions at the boundary of their domain. 55 #3281  
 Kurokawa, Takahide (with Mizuta, Yoshihiro) On the existence of boundary values of  $p$ -precise functions. 56 #3322  
 Mizuta, Yoshihiro On the existence of non-tangential limits of harmonic functions. 56 #3323  
 On the radial limits of Riesz potentials at infinity. 56 #3324  
 See also Kurokawa, Takahide, 56 #3322  
 Topurija, S. B. Boundary properties of the differentiated Poisson integral in a bicylinder. I. (Russian. Georgian summary) 55 #3282

### 31B30 Biharmonic and polyharmonic equations and functions

- Diaz, J. B. (with Ram, R. B.) On biharmonic functions which are always harmonic functions. 55 #3283  
 Edenhofer, J. Eine Integraldarstellung polyharmonischer Funktionen in einem Halbraum. 56 #3325  
 Ram, R. B. See Diaz, J. B., 55 #3283

### 31B35 Connections with differential equations

- Radžabov, N. Potentials and an analogue of the Poisson formula for a certain second order equation with  $n$  singular hyperplanes. (Russian) 56 #3326

### 31B99 None of the above, but in this section

## 31Cxx Other generalizations

### 31C05 Harmonic, subharmonic, superharmonic functions

- Avez, André Fonctions harmoniques positives sur les groupes abéliens. (55 #11328)  
 Chung, Lung Ock (with Sario, Leo) Harmonic and quasiharmonic degeneracy of Riemannian manifolds. 55 #12936  
 Asymptotic behavior and degeneracy of biharmonic functions on Riemannian manifolds. 55 #3284  
 Dellacherie, Claude ★Емкости и случайные процессы. (Russian) [Capacities and random processes] (56 #6811)  
 (Dynkin, E. B.) See Dellacherie, Claude, (56 #6811)  
 González de Buitrago Diaz, Gonzalo The Montel space of vector-valued functions that are harmonic in a domain. (Spanish) 56 #8881  
 Itô, Masayuki Le principe relatif de domination et le principe transitif de domination pour les noyau-fonctions boréliennes. 55 #3285  
 Sur l'unicité du cône convexe divisible relatif au noyau de convolution de Hunt défini par l'opérateur différentiel. 55 #3286  
 Kovtun, I. M. Analytic properties of the solutions of an iterated equation of generalized axially symmetric potential theory. (Russian. English summary) 56 #15959  
 Lukeš, Jaroslav (with Zajíček, Luděk) The insertion of  $G_\delta$  sets and fine topologies. (56 #5808)  
 Nasser Chafii, Mohamed Sur un théorème de Hans Lewy. 55 #3287  
 Nickel, Paul A. Continuity of the linear operator method for strict and weak measure topologies. 56 #3327  
 Rassias, Themistocles M. Un contre-exemple à l'inégalité de Poincaré. (English summary) (55 #13483)  
 Sario, Leo Biharmonic Green's functions and harmonic degeneracy. 56 #3328  
 See also Chung, Lung Ock, 55 #12936  
 Satô, Takeyoshi Integral representation of solutions of the equation  $\Delta u = qu$  on a Riemann surface. (Japanese summary) (55 #3239)  
 (Šur, M. G.) See Dellacherie, Claude, (56 #6811)  
 Yau, Shing Tung Harmonic functions on complete Riemannian manifolds. (55 #4042)  
 Zajíček, Luděk See Lukeš, Jaroslav, (56 #5808)

### 31C10 Pluriharmonic and plurisubharmonic functions [See also 32F05.]

- Hada, Dennis A relation between two biharmonic Green's functions on Riemannian manifolds. 55 #3288  
 Muhlisov, F. G. The existence and uniqueness of the solution of a system of  $m$ -meta-harmonic equations in an unbounded space. (Russian) 56 #645  
 Pčelin, B. K. On the theory of almost everywhere polyharmonic functions. (Russian) 56 #646  
 A sufficient condition for a function to be polyharmonic when it is continuous. (Russian) 56 #647  
 Sario, Leo Biharmonic measure. 56 #12292

### 31C15 Potentials and capacities

- Atahodžev, M. A. Inverse problems of the theory of generalized parabolic potentials. (Russian) (56 #16178)  
 Dellacherie, Claude ★Capacités et processus stochastiques. (56 #6810)  
 Feyel, Denis Un théorème ergodique maximal en théorie du potentiel. (English summary) (55 #619)  
 Itô, Masayuki Sur les noyaux de convolution conditionnellement sous-medians. 55 #8390  
 Lumer, Gunter Images numériques, principe du maximum généralisé, et résolvantes. (56 #12927)  
 Ridder, J. Spezielle Beispiele für äussere und innere Kapazitäten (im Sinne von Choquet). 55 #10709  
 Samko, S. G. Spaces of Riesz potentials. (Russian) (56 #1057)  
 Schulze, Bert-Wolfgang Balayage und Kapazität bei allgemeinen Randwert-Problemen für elliptische Gleichungen höherer Ordnung. (56 #6107)  
 (with Wildenhain, Günther) Potentialtheorie für stark elliptische Systeme höherer Ordnung. (56 #3461)  
 Talagrand, Michel Capacités invariantes. (English summary) (55 #603)  
 Capacités invariantes: le cas alterné. (English summary) (55 #604)  
 Wildenhain, Günther See Schulze, Bert-Wolfgang, (56 #3461)

### 31C20 Discrete potential theory and numerical methods

### 31C25 Dirichlet spaces

- Albeverio, Sergio (with Høegh-Krohn, Raphael) Dirichlet forms and diffusion processes on rigged Hilbert spaces. (56 #13373)  
 Allain, G. La représentation des formes de Dirichlet. 56 #3329  
 Ancona, Alano Sur les espaces de Dirichlet: principes, fonction de Green. 56 #15960  
 Berg, Christian (with Forst, Gunnar) Non-symmetric translation invariant Dirichlet forms. 55 #693  
 Elliott, Joanne Dirichlet spaces and boundary conditions for submarkovian resolvents. (55 #9288)  
 Feyel, Denis (with de la Pradelle, A.) Régularisation de noyaux-fonctions symétriques. 55 #694



- Forst, Gunnar** The definition of energy in non-symmetric translation invariant Dirichlet spaces. **55** #10710  
*See also* **Berg, Christian**, **55** #693
- Fowler, Peter A.** Potential theory in Banach spaces of functions, a condensor theorem. **55** #8391
- Høegh-Krohn, Raphael** *See* **Albeverio, Sergio**, (**56** #13373)
- de la Pradelle, A.** *See* **Feyel, Denis**, **55** #694

**31C99** None of the above, but in this section

- Furstenberg, Harry** Boundaries of Riemannian symmetric spaces. (**55** #10969)
- Nakai, Mitsuru** (*with* Sario, Leo) A nonexistence test for biharmonic Green's functions of clamped bodies. **56** #3330
- Sario, Leo** *See* **Nakai, Mitsuru**, **56** #3330

## 31D05 Axiomatic potential theory

- Anandam, Victor** B. S. capacity in a harmonic space. **55** #695
- Arsove, Maynard** (*with* Leutwiler, Heinz) Potentialtheoretic semigroups. **56** #3331
- Berg, Christian** On Brownian and Poissonian convolution semigroups on the infinite dimensional torus. **55** #10711
- Constantinescu, Corneliu** Le problème de Dirichlet pour des systèmes d'équations non-linéaires. **56** #8882
- Feyel, Denis** (*with* de la Pradelle, A.) Faisceaux maximaux de fonctions associées à un opérateur elliptique du second ordre. (English summary) **55** #12937  
 Un théorème ergodique maximal en théorie du potentiel. (English summary) (**55** #5838)
- Fuglede, Bent** ★Finely harmonic functions. **56** #8883  
 Sur la fonction de Green pour un domaine fin. (English summary) **55** #3289
- Guessous, Hassan** Ouverts  $\mathfrak{B}$ -harmoniques et problème de Dirichlet. (English summary) **55** #696  
 Prolongement surharmonique associé à un couple semi-normal. Applications aux espaces  $\mathfrak{B}$ -harmoniques. (English summary) **56** #5918
- Hansen, Wolfhard** Cohomology in harmonic spaces. **55** #5880  
 Cones simpliciaux de fonctions surharmoniques. **56** #12293
- Hirsch, Francis** Opérateurs dissipatifs et codissipatifs invariants par translations sur les groupes localement compacts. (**56** #6466)
- Ikegami, Teruo** On the regularity of boundary points in a resolute compactification of a harmonic space. **56** #3332
- Kori, Tosiaki** Problème de Neumann sur les espaces harmoniques. **55** #8388
- Leutwiler, Heinz** *See* **Arsove, Maynard**, **56** #3331
- Loeb, Peter A.** Applications of nonstandard analysis to ideal boundaries in potential theory. **56** #15961
- Lukeš, Jaroslav** (*with* Zajiček, Luděk) Connectivity properties of fine topologies. **55** #10712
- Maeda, Fumi-Yuki** Dirichlet integrals on general harmonic spaces. **55** #697
- Murazawa, Tadashi** *See* **Ogawa, Shirô**, **55** #8389
- Ogawa, Shirô** (*with* Murazawa, Tadashi) On the existence of a reproducing kernel on harmonic spaces and its properties. **55** #8389
- Popa, Eugen** Allure de  $u/p_v$  à certaines frontières. **56** #8884
- de la Pradelle, A.** *See* **Feyel, Denis**, **55** #12937
- Schirmeier, Ursula** Isomorphie harmonischer Räume. **55** #10713
- Watanabe, Hisako** Simplexes and Dirichlet problems on locally compact spaces. **55** #3290
- Zajiček, Luděk** *See* **Lukeš, Jaroslav**, **55** #10712

## 32-XX SEVERAL COMPLEX VARIABLES AND ANALYTIC SPACES

**32-01** Elementary exposition (collegiate level)

- Field, M. J.** Holomorphic function theory and complex manifolds. **55** #10714
- Fischer, Gerd** ★Complex analytic geometry. **55** #3291
- Forster, Otto** ★Riemannsche Flächen. (**56** #5867)
- Global analysis and its applications** *See* **Field, M. J.**, **55** #10714

**32-02** Advanced exposition (research surveys, etc.)

- Andreotti, Aldo** Nine lectures on complex analysis. **56** #648

**32-03** Historical

**32-04** Explicit machine computation and programs (not the theory of computation or programming)

**32-06** Collections of papers; proceedings of conferences

- (Aizenberg, L. A.)** *See* **Properties of holomorphic functions of several complex variables**, **55** #10715
- (Baily, W. L., Jr.)** *See* **Complex analysis and algebraic geometry**, (**55** #2882)
- (Gamkrelidze, R. R.)** *See* **Current problems in mathematics**, **56** #649
- (Holm, P.)** *See* **Real and complex singularities**, (**56** #15635)
- (Klemola, Tapio)** *See* **Rencontre sur l'analyse complexe à plusieurs variables et les systèmes surdéterminés**, **55** #3292
- (Kodaira, Kunihiko)** *See* **Complex analysis and algebraic geometry**, (**55** #2882)
- (Lelong, Pierre)** *See* **Séminaire: Pierre Lelong (Analyse)**, **56** #650
- (Matos, Mário C.)** *See* **Infinite dimensional holomorphy and applications**, **56** #8886
- (Mitropol'skii, Ju. O.)** *See* **School: Mathematical**, (**56** #15261)
- (Šestopal, A. F.)** *See* **School: Mathematical**, (**56** #15261)

- (Shioda, Tetsuji)** *See* **Complex analysis and algebraic geometry**, (**55** #2882)
- (Trutnev, V. M.)** *See* **Properties of holomorphic functions of several complex variables**, **55** #10715
- (Wells, R. O., Jr.)** *See* **Several complex variables**, **55** #8392 *and* **Several complex variables**, **55** #8393
- Algebraic analysis and its applications** ★Daisū kaiseikigaku to sono ōyō. (Japanese) [Algebraic analysis and its applications] (**56** #16661)
- Algebraic geometry** *See* **Complex analysis and algebraic geometry**, (**55** #2882)
- Analysis** *See* **Séminaire: Pierre Lelong (Analyse)**, **56** #650
- Analytic functions** *See* **Fonctions analytiques de plusieurs variables et analyse complexe**, **56** #8885
- Analytical functions** *See* **Séminaire: Pierre Lelong (Analyse)**, **56** #650
- Colloques Internationaux du Centre National de la Recherche Scientifique** *See* **Fonctions analytiques de plusieurs variables et analyse complexe**, **56** #8885
- Complex analysis** *See* **Rencontre sur l'analyse complexe à plusieurs variables et les systèmes surdéterminés**, **55** #3292
- Complex analysis and algebraic geometry** ★Complex analysis and algebraic geometry. (**55** #2882)
- Complex variables** *See* **Several complex variables**, **55** #8392
- Conference:**  
**Algebraic Analysis and its Applications** *See* **Algebraic analysis and its applications**, (**56** #16661)
- Current problems in mathematics** ★Современные проблемы математики. Том 4. (Russian) [Current problems in mathematics. Vol. 4] **56** #649
- Fonctions analytiques de plusieurs variables et analyse complexe** ★Fonctions analytiques de plusieurs variables et analyse complexe. **56** #8885
- Functions of several complex variables** *See* **Properties of holomorphic functions of several complex variables**, **55** #10715
- Geometry** *See* **Complex analysis and algebraic geometry**, (**55** #2882)
- Holomorphy** *See* **Infinite dimensional holomorphy and applications**, **56** #8886
- Infinite dimensional holomorphy and applications** ★Infinite dimensional holomorphy and applications. **56** #8886
- Itoji Nauki i Tehniki** *See* **Current problems in mathematics**, **56** #649
- Journées:**  
**Fonctions Analytiques** *See* **Séminaire: Pierre Lelong (Analyse)**, **56** #650
- Kaciveli** *See* **School: Mathematical**, (**56** #15261)
- Montreal, Que.** *See* **Rencontre sur l'analyse complexe à plusieurs variables et les systèmes surdéterminés**, **55** #3292
- Nalchik** *See* **School: Mathematical**, (**56** #15261)
- Oslo** *See* **Real and complex singularities**, (**56** #15635)
- Paris** *See* **Fonctions analytiques de plusieurs variables et analyse complexe**, **56** #8885
- Proceedings of Symposia in Pure Mathematics** *See* **Several complex variables**, **55** #8392 *and* **Several complex variables**, **55** #8393
- Properties of holomorphic functions of several complex variables** ★Некоторые свойства голоморфных функций многих комплексных переменных. (Russian) [Properties of holomorphic functions of several complex variables] **55** #10715
- Real and complex singularities** ★Real and complex singularities, Oslo 1976. (**56** #15635)
- Rencontre sur l'analyse complexe à plusieurs variables et les systèmes surdéterminés** ★Rencontre sur l'analyse complexe à plusieurs variables et les systèmes surdéterminés. **55** #3292
- São Paulo** *See* **Infinite dimensional holomorphy and applications**, **56** #8886
- School:**  
**Mathematical** Десятая математическая школа (пос. Кацивели/Нальчик, 1972 г.). (Russian) [Tenth Mathematical School (Kaciveli/Nalchik, 1972)] (**56** #15261)
- Séminaire:**  
**Pierre Lelong (Analyse)** ★Séminaire Pierre Lelong (Analyse). Année 1975/76 et Journées sur les Fonctions Analytiques, tenues à Toulouse, 5-8 Mai, 1976. **56** #650
- Several complex variables** ★Several complex variables. **55** #8392  
 ★Several complex variables. **55** #8393
- Summer Research Institute:**  
**American Mathematical Society** *See* **Several complex variables**, **55** #8392 *and* **Several complex variables**, **55** #8393
- Summer School:**  
**Mathematical** *See* **School: Mathematical**, (**56** #15261)
- Nordic, Mathematics** *See* **Real and complex singularities**, (**56** #15635)
- Symposium:**  
**Infinite Dimensional Holomorphy and Applications** *See* **Infinite dimensional holomorphy and applications**, **56** #8886
- NAVF Mathematics** *See* **Real and complex singularities**, (**56** #15635)
- Toulouse** *See* **Séminaire: Pierre Lelong (Analyse)**, **56** #650
- Williamstown, Mass.** *See* **Several complex variables**, **55** #8392 *and* **Several complex variables**, **55** #8393

## 32Axx Holomorphic functions of several complex variables

**32A05** Power series, series of functions

- Imai, Akira** A remark on the Weierstrass theorem for convergent power series on a normed space. **55** #3293
- Janušauskas, A. I.** Direct methods for studying the analytic continuability of the sum of a double power series. (Russian. Lithuanian and English summaries) **55** #3294  
 Elementary theorems on the convergence of double Dirichlet series. (Russian) **56** #651
- Maergoiz, L. S.** *See* **Znamenskii, S. V.**, **56** #12294
- Sergott, Ann M.** *See* **Uherka, D. J.**, **55** #8394
- Uherka, D. J.** (*with* Sergott, Ann M.) On the continuous dependence of the roots of a polynomial on its coefficients. **55** #8394
- Znamenskii, S. V.** (*with* Maergoiz, L. S.) Power series in several complex variables. (Russian) **56** #12294



## 32A07 Special domains (Reinhardt, Hartogs, tube domains, etc.)

- Bros, J. (with Iagolnitzer, D.) Tuboïdes dans  $C^n$  et généralisation d'un théorème de Cartan et Grauert. (English summary) **55** #698  
Analytic completion and decomposability properties in tuboid domains. **56** #12295  
Fornaess, John Erik (with Stout, Edgar Lee) Polydiscs in complex manifolds. (55 #8401)  
Iagolnitzer, D. See Bros, J., **55** #698  
de Jager, E. M. On functions holomorphic in tube domains  $\mathbb{R}^n + iC$ . **55** #12938  
Stout, Edgar Lee See Fornæss, John Erik, (55 #8401)  
Vladimirov, V. S. A multidimensional generalization of the Tauberian theorem of Hardy and Littlewood. (Russian) **55** #10716

## 32A10 Holomorphic functions

- Agranovič, P. Z. The existence of a function holomorphic in a cone with a given indicator function for a proximate order. (Russian. English summary) **55** #700  
Gupta, Manjul See Kamthan, P. K., **56** #8888  
Henkin, G. M. See Mitjagin, B. S., (56 #9244)  
Kakičev, V. A. (with Šelković, V. M.) Solution of boundary problems for analytic functions of several variables in the algebras of Vladimirov. (Russian) **56** #8887  
Kamthan, P. K. (with Gupta, Manjul) Linear homeomorphisms in the space of analytic functions in bicylinders. **56** #8888  
Krein, S. G. (with Trofimov, V. P.) Noetherian operators that depend holomorphically on parameters. (Russian) (55 #3839)  
Mihailova, T. S. Local linear separation of analytic singularities of functions of several complex variables. (Russian) **55** #3295  
Mitjagin, B. S. (with Henkin, G. M.) Linear separation of singularities, and a problem of the isomorphism of spaces of holomorphic functions. (Russian) (56 #9244)  
Mkrtčjan, E. S. The reconstruction of a holomorphic function from its values on certain uniqueness sets. (Russian. Armenian summary) **55** #3296  
Nôno, Kiyoharu Separately holomorphic functions. **56** #652  
Persson, Jan On the Cauchy problem in  $C^n$  with singular data. (56 #16128)  
Radlow, James Some explicitly invertible Toeplitz operators on the quarter-plane. (56 #12964)  
Range, R. Michael On the modulus of boundary values of holomorphic functions. **56** #15962  
Šelković, V. M. See Kakičev, V. A., **56** #8887  
Šmul'jan, Ju. L. Certain stability properties for analytic operator-valued functions. (Russian) (55 #1114)  
Trofimov, V. P. See Krein, S. G., (55 #3839)  
Udovičić, Enes An analogue of Puiseux series for functions of several complex variables. (Russian) **56** #653  
Vladimirov, V. S. ★Обобщенные функции в математической физике. (Russian) [Generalized functions in mathematical physics] (56 #9256)  
Zaharjuta, V. P. Extremal plurisubharmonic functions, orthogonal polynomials, and the Bernstein-Walsh theorem for functions of several complex variables. (Russian) **56** #3333

## 32A15 Entire functions

- Agarwal, A. K. A note on geometric means of entire functions of two complex variables. **55** #5881  
Agranovič, P. Z. A remark on the existence of an entire function with a prescribed circular indicator and having proximate order. (Russian. English summary) **56** #5919  
Berenstein, Carlos A. An estimate for the number of zeroes of analytic functions in  $n$ -dimensional cones. **55** #3297  
But, E. N. Entire functions of minimal growth that vanish on algebraic sets. (Russian) **55** #701  
Colombeau, Jean-François (with Perrot, Bernard) Transformation de Fourier-Borel et réflexivité dans les espaces d'applications Silva-analytiques à valeurs vectorielles; applications. (English summary) (56 #1061)  
Gaveau, Bernard (with Vauthier, Jacques) Répartition des zéros des fonctions de type exponentiel sur une variété algébrique affine lisse. (English summary) **55** #3298  
Genčev, Todor Georgiev Entire functions of exponential type with polynomial growth on  $\mathbb{R}_+^n$ . **56** #5920  
Ginzburg, B. N. The growth of entire peak functions of several variables. (Russian) **55** #5882  
Gramain, François Sur les fonctions entières de plusieurs variables complexes prenant des valeurs algébriques aux points entiers. (English summary) **55** #702  
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**Gunning, Robert C.**  $\star$ Riemann surfaces and generalized theta functions. (56 #15991)  
**Wolffhardt, Klaus** Topologische Garben. (55 #3304)

## 32Mxx Complex spaces with a group of automorphisms

32M05 Complex Lie groups, automorphism groups of complex spaces [See also 22E10.]

- Davidov, J. T.** On a principle of compactness and generalization of certain theorems to H. Cartan and Carathéodory. (55 #5901)  
**Kaup, Wilhelm** On the automorphisms of certain symmetric complex manifolds of infinite dimensions. (56 #16002)  
**Lieberman, D. I.** Holomorphic vector fields on projective varieties. (56 #12337)  
**Pisanelli, Domingos** An example of an infinite Lie group. (55 #9181)  
**Šabat, G. B.** The complex structure of domains that cover algebraic surfaces. (Russian) (56 #12304)  
**Shiga, Hironori** On the automorphism of  $C^2$  with invariant axes. 56 #12340  
**Takamoto, Yoshiko** See **Yoshioka, Tsunéo**, (56 #8890)  
**Upmeyer, Harald**  $\star$ Über die Automorphismengruppen beschränkter Gebiete in Banachräumen. 56 #5954  
**Vigné, Jean-Pierre** Le groupe des automorphismes analytiques d'un domaine borné d'un espace de Banach complexe. Application aux domaines bornés symétriques. 55 #3340  
**Yoshioka, Tsunéo** (with **Takamoto, Yoshiko**) Quelques groupes d'automorphismes analytiques de  $C^2$ . (56 #8890)

32M10 Homogeneous complex manifolds [See also 57F15.]

- Alekseevskii, D. V.** Lie groups and homogeneous spaces. (Russian) (55 #568)  
**Andreotti, Aldo** See **Gherardelli, F.**, 55 #8420  
**(Cole, Michael)** See **Lichnerowicz, André**, (55 #11279)  
**Connolly, Frank** (with **Nagano, Tadashi**) The intersection pairing on a homogeneous Kähler manifold. (56 #9560)  
**Dibag, I.** Topology of the complex varieties  $A_1^{(n)}$ . 56 #12341  
**Gherardelli, F.** (with **Andreotti, Aldo**) Some remarks on quasi-Abelian manifolds. 55 #8420  
**Kimura, Tatsuo** See **Sato, Mikio**, 55 #3341  
**Kodama, Akio** (with **Sakane, Yusuke**) Remarks on compact complex hypersurfaces of compact complex parallelisable nilmanifolds. 56 #8925  
**Korányi, Adam** (with **Stein, E. M.**)  $H^2$  spaces of generalized half-planes. 55 #8421  
 (with **Stein, F. Max**) Correction to the paper " $H^2$  spaces of generalized half-planes" (Studia Math. 44 (1972), 379–388). 55 #10733  
**Kowata, Atsutaka** (with **Okamoto, Kiyosato**) Harmonic functions and the Borel-Weil theorem. 56 #16000  
**Lichnerowicz, André**  $\star$ Geometry of groups of transformations. (55 #11279)  
**Nagano, Tadashi** See **Connolly, Frank**, (56 #9560)  
**Okamoto, Kiyosato** See **Kowata, Atsutaka**, 56 #16000  
**Sakane, Yusuke** See **Kodama, Akio**, 56 #8925  
**Satake, Ichirō** On symmetric and quasi-symmetric Siegel domains. 56 #16001  
**Sato, Mikio** (with **Kimura, Tatsuo**) A classification of irreducible prehomogeneous vector spaces and their relative invariants. 55 #3341



- Sommese, Andrew John Theorems of Barth-Lefschetz type for complex subspaces of homogeneous complex manifolds. **55** #8422
- Stein, E. M. See Korányi, Adam, **55** #8421
- Stein, F. Max See Korányi, Adam, **55** #10733
- Tolimieri, Richard The theta transform and the Heisenberg group. (**55** #5795)
- Vesentini, Edoardo Holomorphic functions on Siegel domains. **55** #3342
- Wang, S. P. Homogeneous spaces with finite invariant measure. (**56** #5789)
- Wells, R. O., Jr. (with Wolf, Joseph A.) Poincaré theta series and  $L_1$  cohomology. **56** #8926  
(with Wolf, Joseph A.) Poincaré series and automorphic cohomology on flag domains. **56** #5955
- Wolf, Joseph A. See Wells, R. O., Jr., **56** #8926 and Wells, R. O., Jr., **56** #5955
- Global analysis and its applications See Gherardelli, F.; et al., **55** #8420

32M15 Hermitian symmetric spaces, bounded symmetric domains [See also 22E10, 22E40, 53C35, 57F15.]

- Ash, Avner (with Mumford, David; Rapoport, Michael; Tai, Y.) ★Smooth compactification of locally symmetric varieties. (**56** #15642)
- Avérous, Geneviève (with Kobayashi, Shoshichi) On automorphisms of spaces of non-positive curvature with finite volume. (**56** #1229)
- Chen, Bang Yen Differential geometry of Hermitian symmetric spaces. (**56** #9461)
- Chen, Wu Young (with Ts'eng, Chün Hung) On a convergence theorem in  $H^p$  space. **55** #3343
- Debiard, Amédée Intégrale d'aire de Caldéron-Lusin et intégrale d'aire brownienne sur l'espace hermitien hyperbolique  $D$  de  $C^n$ ,  $n > 1$ . (English summary) **55** #726
- Dragotti, Sara Sulle faccette olomorfe a curvatura massima dello spazio delle matrici simmetriche. (English summary) **56** #5956
- Furstenberg, Harry Boundaries of Riemannian symmetric spaces. (**55** #10969)
- Goodman, Roe W. ★Nilpotent Lie groups: structure and applications to analysis. (**56** #537)
- Hahn, Kyong T. See Mitchell, Josephine, **55** #727
- Kaup, Wilhelm On the automorphisms of certain symmetric complex manifolds of infinite dimensions. **56** #16002  
Algebraic characterization of symmetric complex Banach manifolds. **56** #12342
- Knapp, A. W. A Szegő kernel for discrete series. (**55** #10606)
- Kobayashi, Shoshichi See Avérous, Geneviève, (**56** #1229)
- Korányi, Adam Boundary behaviour of holomorphic functions on bounded symmetric domains. **56** #16003
- Mitchell, Josephine (with Hahn, Kyong T.) Representation of linear functionals in  $H^p$  spaces over bounded symmetric domains in  $C^N$ . **55** #727
- Mumford, David See Ash, Avner; et al., (**56** #15642)
- Rapoport, Michael See Ash, Avner; et al., (**56** #15642)
- Rossi, Hugo (with Vergne, Michèle) Équations de Cauchy-Riemann tangentielles associées à un domaine de Siegel. **56** #3364  
(with Vergne, Michèle) Tangential Cauchy-Riemann equations associated with a Siegel domain. **56** #5957
- Satake, Ichirō Corrections to my paper: "Linear imbeddings of self-dual homogeneous cones" (Nagoya Math. J. **46** (1972), 121–145). **55** #5909
- Schneider, Michael Lefschetz theorems and a vanishing theorem of Grauert-Riemenschneider. (**56** #12314)
- Stoll, Manfred Mean value theorems for harmonic and holomorphic functions on bounded symmetric domains. **55** #10734
- Tai, Y. See Ash, Avner; et al., (**56** #15642)
- Ts'eng, Chün Hung See Chen, Wu Young, **55** #3343
- Urakawa, Hajime On the Hardy class of harmonic sections and vector-valued Poisson integrals. **55** #728
- Vergne, Michèle See Rossi, Hugo, **56** #3364 and Rossi, Hugo, **56** #5957
- Vigué, Jean-Pierre Les domaines bornés symétriques d'un espace de Banach complexe et les systèmes triples de Jordan. **56** #5958

32M99 None of the above, but in this section

- Blattner, Robert J. The metilinear geometry of non-real polarizations. (**56** #9583)
- Suwa, Tatsuo Compact quotients of  $C^3$  by affine transformation groups. II. **56** #12344  
Compact quotients of  $C^3$  by affine transformation groups. **56** #12343

### 32Nxx Automorphic functions [See also 10Dxx, 20H10, 22E40, 30A58.]

- 32N05 General theory of automorphic functions of several complex variables
- Cahn, Robert S. (with Gilkey, Peter B.; Wolf, Joseph A.) Heat equation, proportionality principle, and volume of fundamental domains. (**55** #9170)
- Freitag, Eberhard Singularitäten von Modulmannigfaltigkeiten und Körper automorpher Funktionen. **55** #12959
- Gilkey, Peter B. See Cahn, Robert S.; et al., (**55** #9170)
- Grosche, Jürgen Über die Fundamentalgruppen von Quotientenräumen Siegelscher und Hilbert-Siegelscher Modulgruppen. **56** #3365
- Gunning, Robert C. ★Riemann surfaces and generalized theta functions. (**56** #15991)
- Hammond, William F. Chern numbers of 2-dimensional Satake compactifications. **55** #3344
- Morikawa, Hisasi A note on holomorphic matrix automorphic factors with respect to a lattice in a complex vector space. **55** #12960
- Wolf, Joseph A. See Cahn, Robert S.; et al., (**55** #9170)

32N10 Automorphic forms

- Andreotti, Aldo Complessi di operatori differenziali. (**56** #16703)

- Ash, Avner (with Mumford, David; Rapoport, Michael; Tai, Y.) ★Smooth compactification of locally symmetric varieties. (**56** #15642)
- Freitag, Eberhard Holomorphe Differentialformen zu Kongruenzgruppen der Siegelschen Modulgruppe. **56** #8927
- Hempert, J. C. Cusp forms and the index theorem for manifolds with boundary. (**55** #11315)
- Kubota, Tomio ★Elementary theory of Eisenstein series. (**55** #2759)
- Macheath, A. M. The exponent of convergence of Poincaré series. **56** #684
- Monastyrskii, M. I. Coherent states and discrete groups. (Russian) (**55** #8252)
- Mumford, David See Ash, Avner; et al., (**56** #15642)
- Rapoport, Michael See Ash, Avner; et al., (**56** #15642)
- Satake, Ichirō On the blowing-ups of Hilbert modular surfaces. (**56** #3027)
- Tai, Y. See Ash, Avner; et al., (**56** #15642)
- Vignéras, Marie-France Invariants numériques des groupes de Hilbert. (**55** #2765)
- Wells, R. O., Jr. (with Wolf, Joseph A.) Poincaré theta series and  $L_1$  cohomology. (**56** #8926)  
(with Wolf, Joseph A.) Poincaré series and automorphic cohomology on flag domains. (**56** #5955)
- Wolf, Joseph A. See Wells, R. O., Jr., (**56** #8926) and Wells, R. O., Jr., (**56** #5955)

32N15 Automorphic functions in symmetric domains

- Gangoli, Ramesh Spectra of discrete uniform subgroups of semisimple Lie groups. (**55** #12869)

32N99 None of the above, but in this section

### 33–XX SPECIAL FUNCTIONS [33–XX deals with the properties of functions as functions. General systems of orthogonal functions are treated in 42A52. Expansions in orthogonal functions are treated in 42A56.]

- Emde, F. See Jahnke, E.; et al., **56** #3366
- Jahnke, E. (with Emde, F.; Lösch, F.) ★Специальные функции: Формулы, графики, таблицы. (Russian) [Special functions: Formulae, graphs, tables] **56** #3366
- Lösch, F. See Jahnke, E.; et al., **56** #3366
- (Sedov, L. I.) See Jahnke, E.; et al., **56** #3366
- (Tolstova, G. V.) See Jahnke, E.; et al., **56** #3366
- Tables:  
Special functions See Jahnke, E.; et al., **56** #3366

- Schett, Alois Addendum to: "Properties of the Taylor series expansion coefficients of the Jacobian elliptic functions" (Math. Comp. **30** (1976), no. 133, 143–147). en(**55** #6782)

33–01 Elementary exposition (collegiate level)

- Janić, Radovan R. See Mitrović, Dragoslav S., **55** #10735
- Mitrović, Dragoslav S. (with Janić, Radovan R.) ★Uvod u specijalne funkcije. (Serbo-Croatian) [Introduction to special functions] **55** #10735

33–02 Advanced exposition (research surveys, etc.)

- Henrici, Peter ★Applied and computational complex analysis. Vol. 2. (**56** #12235)

33–03 Historical

33–04 Explicit machine computation and programs (not the theory of computation or programming)

33–06 Collections of papers; proceedings of conferences

33A10 Exponential and trigonometric functions

- Bajić, Branko Note on an improper integral. **55** #10736
- Crouzeix, Michel (with Ruamps, Françoise) On rational approximations to the exponential. **56** #12345
- Eberlein, W. F. On Euler's infinite product for the sine. **55** #3345
- Joshi, S. R. (with Shendge, G. R.) A note on hyperbolic functions. **55** #12961
- Ruamps, Françoise See Crouzeix, Michel, **56** #12345
- Shendge, G. R. See Joshi, S. R., **55** #12961
- Sohin, A. S. An integral representation of Hankel functions. (Russian. English summary) **56** #8928

33A15 Gamma and beta functions

- Agrawal, B. M. (with Singhal, B. M.) A new duplication formula for  $\Gamma(2rz)$ . (Hindi. English summary) **56** #685
- Chaturvedi, K. K. (with Goyal, A. N.) Integrals involving  $A^*$  function. **55** #10737
- Goyal, A. N. See Chaturvedi, K. K., **55** #10737
- Lucht, Lutz Zur Charakterisierung der Gamma-Funktion. **55** #10738
- Ramshaw, Lyle Binomial coefficients with non-integral lower index. **56** #12346
- Singh, R. P. Generalized Struve's function and its recurrence relations. **56** #16004
- Singhal, B. M. See Agrawal, B. M., **56** #685
- Vaisleib, Ju. V. The computation of the sums of certain series containing polygamma functions. (Russian) **55** #5846

33A20 Error function, probability integral

- Blair, J. M. (with Edwards, C. A.; Johnson, J. H.) Rational Chebyshev approximations



for the inverse of the error function. (55 #9479)

Edwards, C. A. See Blair, J. M.; et al., (55 #9479)

Johnson, J. H. See Blair, J. M.; et al., (55 #9479)

Tables:

Čebyšev approximations See Blair, J. M.; et al., (55 #9479)

### 33A25 Elliptic functions and integrals

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Eckhardt, Ulrich A rational approximation to Weierstrass'  $p$  function. II. The lemniscatic case. (German summary) 56 #12347

Geller, Murray Comment on: "New Jacobian theta functions and the evaluation of lattice sums" (J. Mathematical Phys. 16 (1975), no. 11, 2189–2191) by I. J. Zucker. (55 #2006)

Glasser, M. L. Asymptotic evaluation of an integral arising in polaron theory. (55 #954)

(with Zucker, I. J.) Extended Watson integrals for the cubic lattices. 56 #686

Ram, Rishi (with Singh, Bijai; Sharma, V. D.) Some generalised integrals involving elliptic function with application to astrophysics. 55 #3347

Ramamani, V. A proof of the Puiseux-Halphen inequality in the theory of spherical pendulum based on an interesting identity of S. Ramanujan. (56 #5431)

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Zucker, I. J. See Glasser, M. L., 56 #686 and Geller, Murray, (55 #2006)

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### 33A30 Hypergeometric functions of one and several variables, generalizations

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Karlsson, Per W. On the representation of Lauricella functions by Eulerian integrals. 55 #8424

Khanna, I. K. Zeros and orthogonality of the polynomial set  $B_n(x,y)$ . 55 #12963

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Kumar, Virendra (with Agrawal, B. M.) Some identities related to the hypergeometric series  ${}_5F_4$ . (Hindi. English summary) 56 #16006

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On the sum of Appell function  $F_2$ . 56 #3367

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Misra, Arun Prabha On a fractional-differential operator. 55 #3350

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### 33A35 $E$ -functions, $G$ -functions, $H$ -functions, etc.

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- Džrbašjan, M. M.** (with Saakjan, B. A.) General classes of formulas of Taylor-Maclaurin type. (Russian. Armenian and English summaries) **(56 #3266)**
- Gajić, Lj.** (with Stanković, B.) Some properties of Wright's function. **55 #10742**
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- Gupta, Sunil Kumar** Multiplication theorem for the  $H$ -function. **55 #3357**
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- Joshi, C. M.** (with Prajapat, M. L.) On some results concerning generalised  $H$ -function of two variables. **56 #12351**
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34J05 General theory



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- Kulesko, N. A.** (with **Levin, B. Ja.**) The completeness of the Floquet solutions for second order differential equations with deviating argument. (Russian) **56** #12501
- Kurzweil, Jaroslav** Global solutions of functional differential equations. **55** #3474
- Kusano, Takasi** (with **Onose, Hiroshi**) A nonoscillation theorem for a second order sublinear retarded differential equation. **55** #10803  
(with **Onose, Hiroshi**) Asymptotic behavior of nonoscillatory solutions of nonlinear differential equations with forcing term. (Italian summary) **55** #10804  
(with **Onose, Hiroshi**) Asymptotic decay of oscillatory solutions of second order differential equations with forcing term. **56** #16105
- Kusano, Takasi** (with **Onose, Hiroshi**) Nonlinear oscillation of second order functional differential equations with advanced argument. **55** #13043
- Ladas, G.** (with **Lakshmikantham, V.**) Oscillations caused by retarded actions. **55** #3475  
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- Lakshmikantham, V.** See **Ladas, G.**, **55** #3475
- Lardner, R. W.** (with **Bojadziev, G. N.**) Non-linear differential equations with damping and large time delay. **56** #3430
- Levin, B. Ja.** See **Kulesko, N. A.**, **56** #12501
- Limanskii, V. G.** The bounded solutions of first order operator-differential equations. (Russian) **56** #12502
- Liu, Tsai Sheng** Oscillation of solutions of higher order functional differential equations and damped differential equations. **56** #12503
- Lovelady, David Lowell** Oscillation and a class of linear delay differential equations. **55** #3476
- Mahfoud, W. E.** Oscillation and asymptotic behavior of solutions of  $N$ th order nonlinear delay differential equations. **56** #16106
- Mallet-Paret, John** Generic periodic solutions of functional differential equations. (56 #1370)
- Manitius, Andrzej** See **Banks, H. T.**, **55** #8514
- Mitropol'skii, Ju. O.** (with **Ševelo, V. M.**) The development of the oscillation theory of the solutions of differential equations with retarded argument. (Russian) **56** #800
- Myrzaliyev, Dž.** Existence of integral manifolds for systems of differential equations with retarded argument. (Russian) **56** #12504
- Naito, Manabu** (with **Kitamura, Yuichi**) On the asymptotic relationships between two systems of differential equations. **55** #3477
- Neimark, Ju. I.** (with **Fišman, L. Z.**) Structure of the phase space of quasilinear differential equations of neutral type. (Russian. English summary) **56** #16107
- Nguyen Khak Lan** A study of the oscillations of a sampled-data system with slowly varying parameters and with lag. (Russian) **56** #9038
- Nussbaum, Roger D.** A correction of: "Periodic solutions of some nonlinear, autonomous functional differential equations. II" (J. Differential Equations **14** (1973), 360-394). **55** #809  
A bifurcation theorem with applications to some autonomous functional differential equations. (55 #3892)  
Global bifurcation of periodic solutions of some autonomous functional differential equations. **55** #3478  
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- Onose, Hiroshi** On oscillatory properties of functional differential equations. **56** #12505  
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- Ordins'ka, Z. P.** The behavior of the solutions of a system of differential equations with lag near an integral manifold. (Russian) **56** #801  
On the question of the existence of an invariant toroidal manifold for a system with lag. (Russian) **56** #6057
- Philos, Ch. G.** See **Staikos, V. A.**, **55** #8518
- Rouche, Nicolas** The invariance of limit sets for retarded differential equations. (French summary) **55** #810
- Ségulier, Pierre** See **Arino, Ovide**, **56** #794
- Selfert, George** Positively invariant closed sets for systems of delay differential equations. **55** #811
- Šerman, P. B.** See **Borisovič, Ju. G.**, **55** #805
- Ševelo, V. M.** See **Vareh, N. V.**; et al., **55** #813 and **Mitropol'skii, Ju. O.**, **56** #800
- Singh, Bhagat** Oscillation and nonoscillation of even-order nonlinear delay-differential equations. **55** #8516  
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- Spikes, Paul W.** See **Graef, John R.**, **56** #12499
- Staikos, V. A.** (with **Philos, Ch. G.**) On the asymptotic behavior of nonoscillatory solutions of differential equations with deviating arguments. **55** #8518  
(with **Stavroulakis, I. P.**) Bounded oscillations under the effect of retardations for differential equations of arbitrary order. **56** #12507
- Stavroulakis, I. P.** See **Staikos, V. A.**, **56** #12507
- Stokes, Arnold P.** On the existence of periodic solutions of functional differential equations. **56** #16108  
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- Švec, Marko** Some properties of functional differential equations. (Italian summary) **55** #3481
- Sztaba, Urszula** Some properties of solutions of differential equations with retarded arguments. **55** #3482
- Terry, Raymond D.** Oscillatory and asymptotic properties of homogeneous and nonhomogeneous delay differential equations of even order. **55** #812  
Positive solutions of  $D^n[r(t)D^m y(t)] = p(t)y(t-\tau(t))$ . **56** #12508
- Tomaras, Alexander** Oscillations of a first order functional differential equation. **56** #12509
- Tomiuk, J.** See **Hadeler, K. P.**, **56** #799
- Turbabin, A. S.** See **Borisovič, Ju. G.**, **55** #13040
- Vareh, N. V.** (with **Gricai, A. G.**; **Ševelo, V. M.**) The oscillation of the solutions of certain systems of differential equations with retarded argument. (Russian) **55** #813
- Werbowski, Jaroslav** Some oscillation criteria for differential equations with delayed arguments. (Polish summary) **56** #802
- Yeh, Cheh Chih** See **Chen, Ming Po**; et al., **55** #13041
- Yorke, James A.** See **Kaplan, James L.**, **55** #807
- Yu, Cheng Shu** Forced oscillations for retarded differential equations. **56** #12510  
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## 34K20 Stability theory

- Ansari, J. S.** Modified Liapunov-Razumikhin stability condition for extended range of applicability. **55** #13045
- Bojarkin, G. N.** (with **Smyšljaeva, L. G.**) Systems of linear differential equations with sampled-data components. (Russian) **56** #9039
- Braddock, R. D.** (with **van den Driessche, Pauline**) On the stability of differential-difference equations. **56** #6058
- Carr, Jack** (with **Dyson, Janet**) The functional differential equation  $y'(x) = ay(\lambda x) + by(x)$ . **56** #803  
(with **Dyson, Janet**) The matrix functional differential equation  $y'(x) = Ay(\lambda x) + By(x)$ . **56** #804
- Chen, Lu San** (with **Yeh, Cheh Chih**) Asymptotic nature of nonoscillatory solutions of nonlinear retarded differential equations. **56** #12511
- Cygankova, L. A.** Some methods for the determination of the region of practical stability of linear systems with constant lag. (Russian. English summary) **56** #16109
- Datko, Richard** An algorithm for computing Liapunov functionals for some differential-difference equations. **56** #12512  
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- Deo, S. G.** ★Mixed stability and functional differential systems. **55** #5982
- Doden, Klaus** Gleichmäßig asymptotische Stabilität stationärer Punkte bei Differential-Differenzengleichungen. **56** #3432
- van den Driessche, Pauline** See **Braddock, R. D.**, **56** #6058
- Dyson, Janet** (with **Villelrvith Pelevina, A. F.**) Absolute stability of automatic control systems with lag. (Russian) (56 #16502)
- Györi, István** Remarks on the differential equations of population growth models. (Russian. English summary) **56** #16110
- Haddock, John R.** Some new results on stability and convergence of solutions of ordinary and functional differential equations. **56** #12514  
Asymptotic behavior of solutions of nonlinear functional differential equations in Banach space. (56 #786)
- Hino, Yoshiyuki** Stability and existence of almost periodic solutions of some functional differential equations. **55** #8519
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- Israfilov, R. H.** Sufficient conditions for the asymptotic stability of a second order differential equation with retarded argument. (Russian) **56** #9041
- Jarnik, Jiří** (with **Kurzweil, Jaroslav**) Ryabov's special solutions of functional differential equations. (Italian summary) **56** #12515
- Kurihara, Mitsunobu** On an asymptotic behavior of solutions of differential-difference equations. **55** #5983
- Kurzweil, Jaroslav** See **Jarnik, Jiří**, **56** #12515



- Lee, Muo S. (with Hsu, C. S.) On the  $\tau$ -decomposition method of stability analysis for retarded dynamical systems. 55 #10805
- Li, Ok Yŏn Uniform boundedness of the limits of the solutions of retarded differential equations. (Korean. English summary) 55 #13048
- Lim, Eng-Bin Asymptotic behavior of solutions of the functional differential equation  $x'(t) = Ax(\lambda t) + Bx(t)$ ,  $\lambda < 0$ . 56 #6059
- Martinjuk, A. A. ★Устойчивость движения сложных систем. (Russian) [Stability of motion of complex systems] (55 #5966)
- Michel, Anthony N. See Miller, Richard K., (55 #10984)
- Miller, Richard K. (with Michel, Anthony N.)  $L_2$ -stability and -instability of large-scale systems described by integrodifferential equations. (55 #10984)
- Muraton, Ju. (with Sabirov, T.) Some theorems on the perturbation of the spectrum of a holomorphic matrix pencil, and their applications in the theory of the stability of systems with aftereffect. (Russian) 56 #9042
- Pae, Myŏng Sŏng Stability of the solutions of a system of retarded differential equations. (Korean. English summary) 55 #5984
- Pecell, Giampiero Functional-differential equations: dichotomies, perturbations, and admissibility. 56 #9043
- Pelevina, A. F. See Gromova, P. S., (56 #16502)
- Plant, Andrew T. Stability of nonlinear functional differential equations using weighted norms. 55 #3483
- Răsvan, Vladimir Absolute stability of a class of control systems described by functional differential equations of neutral type. 55 #8520
- Sabirov, T. See Muraton, Ju., 56 #9042
- Skripnik, V. P. Stability criteria for systems with transformed argument that are based on the symmetrization of matrices. (Russian) 55 #13049
- Stability of functional-differential equations. (Russian. English summary) 56 #6060
- Asymptotic behavior of the solutions of systems with transformed argument. (Russian) 56 #805
- Smith, Russell A. Inclusion conditions for Hurwitzian and Schur sets in  $\mathbb{C}^{n+1}$ . (56 #15892)
- Smyšljajeva, L. G. See Bojarkin, G. N., 56 #9039
- Strygin, V. V. Bifurcations of small self-induced oscillations of singularly perturbed systems of retarded type. (Russian) 56 #9044
- Ved', Ju. A. Asymptotic properties of the solutions of equations with after-effect. (Russian. Loose Russian summary) 55 #5985
- Villella Bressan, Rosanna See Dyson, Janet, (56 #784)
- Yeh, Cheh Chih See Chen, Lu San, 56 #12511
- Žautykov, A. O. A case of the concrete construction of functionals for a countable system of equations with lag. (Russian. Kazakh summary) 56 #9045

### 34K25 Asymptotic theory

- Chen, Lu San Some oscillation theorem for differential equations with functional arguments. 55 #5986
- Cushing, J. M. Stable positive periodic solutions of the time-dependent logistic equation under possible hereditary influences. 56 #6061
- Fodčuk, V. I. Asymptotic Krylov-Bogolubov-Mitropol'skiĭ methods for differential equations of neutral type. (Russian. Polish and English summaries) 56 #9046
- Hekimova, M. A. See Rožkov, V. I., 56 #807
- Mitropol'skiĭ, Ju. O. (with Nguen Khak Lan) Oscillations of systems with a lag that depends on the state of the system. (Russian) 56 #6062
- Nguen Khak Lan See Mitropol'skiĭ, Ju. O., 56 #6062
- Plotnikov, A. A. See Vasil'eva, A. B., 56 #9047
- Romanenko, O. Ju. Representation of the solutions of quasilinear differential-functional equations of neutral type in the case of resonance. (Russian) 56 #806
- Rožkov, V. I. (with Hekimova, M. A.) A method for studying the periodic solutions of systems of difference and differential-difference equations with small lag. (Russian) 56 #807
- Vasil'eva, A. B. (with Plotnikov, A. A.) Certain critical cases for equations of neutral type with small lag. (Russian. Polish and English summaries) 56 #9047

### 34K99 None of the above, but in this section

- Delfour, M. C. State theory of linear hereditary differential systems. (56 #11234)
- (Halany, A.) See Răsvan, Vladimir, (56 #11317)
- Jeffries, D. L. See Oğuztöreli, Mehmet Namık; et al., (55 #5230)
- Leung, Kin-Vinh See Oğuztöreli, Mehmet Namık; et al., (55 #5230)
- Manitius, Andrzej Controllability, observability and stabilizability of retarded systems. (56 #17953)
- Oğuztöreli, Mehmet Namık (with Jeffries, D. L.; Leung, Kin-Vinh) A kinetic study of enzyme systems. (55 #5230)
- Răsvan, Vladimir ★Stabilitatea absolută a sistemelor automate cu întârziere. (Romanian) [Absolute stability of automatic time-lag systems] (56 #11317)

## 35-XX PARTIAL DIFFERENTIAL EQUATIONS

### 35-01 Elementary exposition (collegiate level)

- Bobik, O. I. (with Bodnarčuk, P. I.; Ptašnik, B. I.; Skorobogat'ko, V. Ja.) ★Елементи якісної теорії диференціальних рівнянь з частинними похідними. (Ukrainian) [Elements of the qualitative theory of partial differential equations] 56 #12516
- Bodnarčuk, P. I. See Bobik, O. I.; et al., 56 #12516
- Dou, Alberto (with Mendizabal, Alfredo) ★Ecuaciones en derivadas parciales y su resolución numerica. (Spanish) [Partial differential equations and their numerical solution] 55 #5987
- Friedman, Avner ★Partial differential equations. 56 #3433
- Hudjaev, S. I. See Vol'pert, A. I., (55 #903)
- Karimova, H. H. See Vladimirov, V. S.; et al., 55 #5988

- Krall, Allan M. ★Linear methods of applied analysis. (56 #5099)
- Mendizabal, Alfredo See Dou, Alberto, 55 #5987
- Mihailov, V. P. See Vladimirov, V. S.; et al., 55 #5988
- (Petrova, Irina) See Vladimirov, V. S.; et al., 55 #5988
- Ptašnik, B. I. See Bobik, O. I.; et al., 56 #12516
- Šabunin, M. I. See Vladimirov, V. S.; et al., 55 #5988
- Sidorov, Ju. V. See Vladimirov, V. S.; et al., 55 #5988
- Skorobogat'ko, V. Ja. See Bobik, O. I.; et al., 56 #12516
- Vašarin, A. A. See Vladimirov, V. S.; et al., 55 #5988
- Vladimirov, V. S. (with Mihailov, V. P.; Šabunin, M. I.; Karimova, H. H.; Sidorov, Ju. V.; Vašarin, A. A.) ★Recueil de problèmes d'équations de physique mathématique. 55 #5988
- Vol'pert, A. I. (with Hudjaev, S. I.) ★Анализ в классах разрывных функций и уравнения математической физики. (Russian) [Analysis in classes of discontinuous functions, and the equations of mathematical physics] (55 #903)

### 35-02 Advanced exposition (research surveys, etc.)

- (Egorov, Ju. V.) See Nirenberg, Louis, 56 #9049
- (Fife, Paul C.) See Oleinik, O. A.; et al., 56 #16112
- Friedman, Avner ★Partial differential equations. (56 #3433)
- ★Partial differential equations. 56 #12517
- Nirenberg, Louis ★Lectures on linear partial differential equations. 56 #9048
- Lectures on linear partial differential equations. (Russian) 56 #9049
- Oleinik, O. A. (with Radkevič, E. V.) Second order equations with nonnegative characteristic form. (Russian) 56 #16111
- (with Radkevič, E. V.) ★Second order equations with nonnegative characteristic form. 56 #16112
- Radkevič, E. V. See Oleinik, O. A., 56 #16112
- Radkevič, E. V. See Oleinik, O. A., 56 #16111
- Serrin, James The solvability of boundary value problems. 55 #814
- Trèves, François ★Basic linear partial differential equations. 56 #6063

### 35-03 Historical

- Aleksandrov, P. S. (with Bicadze, A. V.; Višik, M. I.; Oleinik, O. A.) Il'ja Nestorovič Vekua (on the occasion of his seventieth birthday). (Russian) (56 #8299)
- Bicadze, A. V. See Aleksandrov, P. S.; et al., (56 #8299)
- Oleinik, O. A. See Aleksandrov, P. S.; et al., (56 #8299)
- Serrin, James The solvability of boundary value problems. (55 #814)
- (Vekua, I. N.) See Aleksandrov, P. S.; et al., (56 #8299)
- Višik, M. I. See Aleksandrov, P. S.; et al., (56 #8299)
- Bibliography:
- Vekua, I. N. See Aleksandrov, P. S.; et al., (56 #8299)
- Birthday:
- Vekua, I. N. See Aleksandrov, P. S.; et al., (56 #8299)

### 35-04 Explicit machine computation and programs (not the theory of computation or programming)

### 35-06 Collections of papers; proceedings of conferences

- (Brauner, Claude-Michel) See Singular perturbations and boundary layer theory, 56 #810
- (Camus, Jacques) See Journées: Équations aux Dérivées Partielles de Rennes, 56 #12519
- (Dubinskii, Ju. A.) See Studies in differential equations and their applications, (55 #19)
- (Džuraev, A.) See Studies on boundary value problems and integral equations, 56 #811
- (Džuraev, T. D.) See Boundary value problems for differential equations, 56 #808
- (Fitzgibbon, W. E., III) See Nonlinear diffusion, 56 #809
- (Garnir, H. G.) See Boundary value problems for linear evolution: partial differential equations, 56 #9050
- (Gay, B.) See Singular perturbations and boundary layer theory, 56 #810
- (Goulaouic, Charles) See Séminaire: Goulaouic-Schwartz, 55 #13050
- (Lomov, S. A.) See Studies in differential equations and their applications, (55 #19)
- (Mathieu, Jean) See Singular perturbations and boundary layer theory, 56 #810
- (Meister, V. E.) See Function theoretic methods for partial differential equations, 56 #12518
- (Mitropol'skiĭ, Ju. O.) See Boundary value problems of the electrodynamics of conducting media, 55 #3484
- (Pohožaev, S. I.) See Studies in differential equations and their applications, (55 #19)
- (Salahitdinov, M. S.) See Boundary value problems for partial differential equations, 55 #3485 and Boundary value problems for differential equations, 56 #808
- (Schwartz, Laurent) See Séminaire: Goulaouic-Schwartz, 55 #13050
- (Walker, Homer F.) See Nonlinear diffusion, 56 #809
- (Weck, Norbert) See Function theoretic methods for partial differential equations, 56 #12518
- (Wendland, Wolfgang L.) See Function theoretic methods for partial differential equations, 56 #12518
- Boundary layer theory See Singular perturbations and boundary layer theory, 56 #810
- Boundary value problems See Studies on boundary value problems and integral equations, 56 #811
- Boundary value problems for differential equations ★Краевые задачи для дифференциальных уравнений. Вып. 2. (Russian) [Boundary value problems for differential equations. No. 2] 56 #6064
- ★Краевые задачи для дифференциальных уравнений. 5. (Russian) [Boundary value problems for differential equations. 5] 56 #808
- Boundary value problems of the electrodynamics of conducting media ★Краевые задачи электродинамики проводящих сред. (Russian) [Boundary value problems of the electrodynamics of conducting media] 55 #3484



- Boundary value problems for linear evolution: partial differential equations** ★Boundary value problems for linear evolution: partial differential equations. **56** #9050
- Boundary value problems for partial differential equations** ★Краевые задачи для дифференциальных уравнений с частными производными. (Russian) [Boundary value problems for partial differential equations] **55** #3485
- Conference:**
- NSF-CBMS Regional, Nonlinear Diffusion Equations *See* Nonlinear diffusion, **56** #809
- Partial Differential Equations and Hyperfunctions** *See* Theory of partial differential equations and theory of hyperfunctions, **56** #16113
- Singular Perturbations and Boundary Layer Theory** *See* Singular perturbations and boundary layer theory, **56** #810
- Washington State University, Mathematical Topics in Stability Theory** ★Proceedings of the Washington State University Conference on Mathematical Topics in Stability Theory. (55 #12388)
- Darmstadt** *See* Function theoretic methods for partial differential equations, **56** #12518
- Differential equations** *See* Boundary value problems for differential equations, **56** #6064; Studies in differential equations and their applications, (55 #19) and Boundary value problems for differential equations, **56** #808
- Distributions and linear differential equations** ★Distributions and linear differential equations, (56 #9)
- Electrodynamics** *See* Boundary value problems of the electrodynamics of conducting media, **55** #3484
- Function theoretic methods for partial differential equations** ★Function theoretic methods for partial differential equations. **56** #12518
- Functional analysis** *See* Séminaire: Goulaouic-Schwartz, **56** #12520 and Séminaire: Goulaouic-Schwartz, **55** #13050
- Houston, Tex.** *See* Nonlinear diffusion, **56** #809
- Hyperfunctions** *See* Theory of partial differential equations and theory of hyperfunctions, **56** #16113
- Integral equations** *See* Studies on boundary value problems and integral equations, **56** #811
- Journées:**
- Équations aux Dérivées Partielles de Rennes ★Journées: Équations aux Dérivées Partielles de Rennes. **56** #12519
- Kyoto** *See* Distributions and linear differential equations, (56 #9)
- Liege** *See* Boundary value problems for linear evolution: partial differential equations, **56** #9050
- Linear differential equations** *See* Distributions and linear differential equations, (56 #9)
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- NATO Advanced Study Institute:**
- Boundary Value Problems for Linear Evolution *See* Boundary value problems for linear evolution: partial differential equations, **56** #9050
- Nonlinear diffusion** ★Nonlinear diffusion. **56** #809
- Partial differential equation** *See* Journées: Équations aux Dérivées Partielles de Rennes, **56** #12519
- Partial differential equations** *See* Boundary value problems for partial differential equations, **55** #3485; Theory of partial differential equations and theory of hyperfunctions, **56** #16113; Function theoretic methods for partial differential equations, **56** #12518; Séminaire: Goulaouic-Schwartz, **56** #12520; Séminaire: Goulaouic-Schwartz, **55** #13050 and Boundary value problems for linear evolution: partial differential equations, **56** #9050
- Pullman, Wash.** *See* Conference: Washington State University, Mathematical Topics in Stability Theory, (55 #12388)
- Séminaire:**
- Goulaouic-Schwartz ★Séminaire Goulaouic-Schwartz 1975/1976: Équations aux dérivées partielles et analyse fonctionnelle. **56** #12520
- ★Séminaire Goulaouic-Schwartz 1976/1977: Équations aux dérivées partielles et analyse fonctionnelle. **55** #13050
- Singular perturbations and boundary layer theory** ★Singular perturbations and boundary layer theory. **56** #810
- Stability theory** *See* Conference: Washington State University, Mathematical Topics in Stability Theory, (55 #12388)
- Studies on boundary value problems and integral equations** ★Исследования по краевым задачам и интегральным уравнениям. (Russian) [Studies on boundary value problems and integral equations] **56** #811
- Studies in differential equations and their applications** ★Исследования по дифференциальным уравнениям и их приложениям. (Russian) [Studies in differential equations and their applications] (55 #19)
- Symposium:**
- Distributions and Linear Differential Equations *See* Distributions and linear differential equations, (56 #9)
- Function Theoretic Methods for Partial Differential Equations** *See* Function theoretic methods for partial differential equations, **56** #12518
- Theory of partial differential equations and theory of hyperfunctions** ★Chôkansûron to henbibunhôteishiki no riron. (Japanese) [Theory of partial differential equations and theory of hyperfunctions] **56** #16113

## 35Axx General theory

### 35A05 General existence and uniqueness theorems

- Bautin, S. P.** The characteristic Cauchy problem for a quasilinear analytic system. (Russian) **55** #13051
- Bronšteĭn, M. D.** Differential equations that have nonanalytic solutions. (Russian) **55** #10806
- Durĭkoviĭ, Vladimír** On the existence and the uniqueness of solutions and on the convergence of successive approximations in the Darboux problem for certain dif-

ferential equations of the type  $u_{x_1 \dots x_n} = f(x_1, \dots, x_n, u, \dots, u_{x_1, \dots, x_1}, \dots)$ . (Czech summary) **56** #9051

- Goldschmidt, H.** On the local solvability of linear partial differential equations. (56 #6079)
- Kokareva, T. A.** The analytic solutions of the Cauchy problem for certain integro-differential equations. (Russian) **55** #10807
- Miranda, Manuel Milla** Analyse numérique d'un problème non linéaire d'évolution. (English summary) **55** #815
- Nakaoka, Akira** On uniqueness of analytic solution for first order partial differential equations with degenerate principal symbols. II. **55** #8521
- Ninomiya, Haruki** Some remarks on the uniqueness in the Cauchy problem for a first-order partial differential equation in two variables. **55** #816
- On existence of independent solution of first-order partial differential equations in two variables. **56** #812
- de Paris, Jean-Claude** (with Wagschal, Claude) Problème de Cauchy analytique à caractéristiques multiples. (English summary) **55** #10808
- Radochová, Věra** Existence theorems for a partial differential equation of the fourth order. **55** #8522
- Wagschal, Claude** *See* de Paris, Jean-Claude, **55** #10808

### 35A10 Cauchy-Kowalewski theorems

- Du Chateau, Paul** ★The Cauchy-Goursat problem. **56** #12521

### 35A15 Variational methods

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- Oja, P. E. See Vainikko, G. M., **(56)** #12936
- Ravaglia, Carlo Teoremi di confronto e di separazione per equazioni differenziali alle derivate parziali in uno spazio di Hilbert. (English summary) **(55)** #3489
- Sambors'kii, S. M. Dependence on parameters of the solutions of evolution equations. (Russian) **(56)** #16093
- Šihvatov, A. M. See Krein, S. G., **(55)** #12868
- Vainikko, G. M. (with Oja, P. E.) The convergence and rate of convergence of the Galerkin method for abstract evolution equations. (Russian) **(56)** #12936
- 35R25 Improperly posed problems**
- Berlinkov, V. M. Estimates of the modulus of continuity of certain differential operators. (Russian) **(56)** #6088



**Obeščenko, M. P.** Sufficient conditions of the correctness of boundary value problems with a normal derivative on the characteristic. (Russian) **56** #12682  
**Wakita, Masu** Non-well posedness of the Cauchy problem for a partial differential operator with constant coefficients. (**56** #6083)

### 35R30 Inverse problems (undetermined coefficients, etc.)

**Anikonov, Ju. E.** A uniqueness theorem for the solution of the inverse problem for a quasilinear hyperbolic equation. (Russian) (**56** #12623)  
**Atahodjaev, M. A.** Inverse problems of the theory of generalized parabolic potentials. (Russian) **56** #16178  
**Azarkevič, N. N.** A certain inverse problem of heat conduction. (Russian) **56** #12683  
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**Eldesbaev, T.** A certain inverse problem for the Euler-Darboux-Poisson equation. (Russian) **55** #905  
**Gorbačuk, V. I.** Inverse theorems on the approximation by biharmonic functions. (Russian) (**56** #9149)  
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**Mališev, I. G.** A certain inverse problem for a parabolic equation with a variable coefficient. (Ukrainian. English and Russian summaries) **55** #13105  
**Malyšev, I. G.** (with Malyševa, G. M.) The approximate determination of the coefficients in the heat equation. (Russian. English summary) **56** #12684  
**Malyševa, G. M.** See **Malyšev, I. G.**, **56** #12684  
**Megrabov, A. G.** Some certain inverse problems for an equation of mixed type. (Russian) (**56** #3475)  
**Romanov, V. G.** ★Обратные задачи для дифференциальных уравнений. (Russian) [Inverse problems for differential equations] **56** #6168  
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**Kato, Tosio** Singular perturbation and semigroup theory. (**56** #16447)  
**Ladik, J. F.** See **Chiu, S. C.**, (**55** #1167)  
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**Beals, Richard** Characterization of pseudodifferential operators and applications. (**55** #8884)  
 Square roots of nonnegative systems and the sharp Gårding inequality. **55** #8596  
**Bengel, Gunter** Wave front sets and singular supports of convolutions. (**56** #16367)  
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**Čistjakov, B. N.** Conditions for the convergence to a polynomial at infinity of the solutions of a certain class of pseudodifferential equations. (Russian) (**56** #16117)  
**Cordes, Heinz O.** (with Herman, E. A.) Gelf'and theory of pseudo differential operators. (**56** #12991)  
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**Ifitimie, Viorel** See **Croc, Elisabeth; et al.**, (**55** #839)  
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**Melin, Anders** (with Sjöstrand, Johannes) Fourier integral operators with complex-valued phase functions. (**55** #4290)  
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 (with Sjöstrand, Johannes) A calculus for Fourier integral operators in domains with boundary and applications to the oblique derivative problem. (**56** #16708)  
**Menikoff, A.** Parametrix for subelliptic operators. (**56** #3451)  
**Mossaheb, Shahkar** (with Okada, Masami) Une classe d'opérateurs pseudo-différentiels bornés sur  $L^r(\mathbb{R}^n)$ ,  $1 < r < \infty$ . (English summary) (**56** #9330)  
**Nagase, Michihiro** See **Kumano-go, Hitoshi**, (**55** #11107)  
**Nirenberg, Louis** (with Treves, J. F.) A correction to: "On local solvability of linear partial differential equations. II. Sufficient conditions" (Comm. Pure Appl. Math. **23** (1970), 459–509). **55** #8599  
**Okada, Masami** See **Mossaheb, Shahkar**, (**56** #9330)  
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**Stephan, E.** Differenzenapproximation von Pseudo-Differentialgleichungen. **55** #907  
**Taylor, Michael E.** ★Pseudo differential operators. **56** #905  
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**Unterberger, André** Classes de symboles associées aux champs de repères orthogonaux de la forme  $\langle x, \xi \rangle$ . (English summary) (**56** #16710)  
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**Antonec, M. A.** The classical limit of solutions of the Cauchy problem for hypoelliptic Weyl symbols. (Russian) **56** #16182  
**Bony, Jean-Michel** Propagation of analytic and differentiable singularities for solutions of partial differential equations. (**56** #12522)  
**Cordes, Heinz O.** (with McOwen, Robert C.) The  $C^*$ -algebra of a singular elliptic problem on a noncompact Riemannian manifold. (**55** #4289)  
**Ivrii, V. Ja.** Wave fronts of the solutions of symmetric pseudodifferential systems. (Russian) **56** #3486  
**McOwen, Robert C.** See **Cordes, Heinz O.**, (**55** #4289)  
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**Dikanskii, A. S.** The necessity of normal solvability conditions of boundary value problems for systems of pseudodifferential equations. (Russian) (**56** #12992)  
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**Fedosov, B. V.** Analytic formula for the index of an elliptic boundary value problem. III. (Russian) (**56** #6757)  
**Parenti, Cesare** Operatori pseudo-differenziali in  $\mathbb{R}^n$  e applicazioni. (English summary) (**55** #10838)  
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**Schulze, Bert-Wolfgang** On the set of all elliptic boundary value problems for an elliptic pseudodifferential operator on a manifold. (**56** #16709)  
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# 39-XX FINITE DIFFERENCES AND FUNCTIONAL EQUATIONS

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**Kirsch, Arnold** Die Funktionalgleichung  $f(x+x')=f(x)+f(x')$  als Thema für den Oberstufenunterricht. **56** #9118

## 39-02 Advanced exposition (research surveys, etc.)

## 39-03 Historical

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## 39-06 Collections of papers; proceedings of conferences

## 39A05 Finite differences, general

**Bakalov, P. M.** (with Grigor'ev, V. A.) A study of the stability of the solutions of pseudorandom finite difference equations by the first method. (Russian) **56** #12686

**Berkey, Dennis D.** A Gerschgorin theorem for difference equations. II. **56** #3487

**Danov, A. D.** See **Katev, T. P.**, **56** #9120

**Gopengauz, B. E.** A characteristic property of a divided difference and some of its applications. (Russian) (**56** #15897)

**Grigor'ev, V. A.** See **Bakalov, P. M.**, **56** #12686

**Holnicki, Piotr** The maximum principle for a certain class of difference boundary value problems. (Polish) **56** #9119

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**Pachpatte, B. G.** A note on some finite difference inequalities. **56** #12687

**Phares, Alain J.** A general theory of linear finite-difference equations with a few applications. **55** #13107

**Zeilberger, Doron** Binary operations in the set of solutions of a partial difference equation. **55** #13108

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**Ascarì, Aldo** Risoluzione di un problema al contorno per una classe di equazioni alle differenze finite in due variabili. **55** #3580

**Bojarincev, Ju. E.** The solvability of boundary value problems for systems of ordinary difference equations. (Russian) **56** #16183

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**Casagrande, F.** (with Montaldi, E.) Some remarks on finite-difference equations of physical interest. (Italian and Russian summaries) **56** #6171

**Chiu, S. C.** (with Ladik, J. F.) Generating exactly soluble nonlinear discrete evolution equations by a generalized Wronskian technique. (**55** #1167)

**Denef, J.** (with Piessens, Robert) The asymptotic behaviour of solutions of difference equations of Poincaré's type. **56** #16184

**Derr, V. Ja.** A criterion for the nonoscillation of a linear difference equation. (Russian) **55** #908

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**Ėrgašev, A.** An operator method for the solution of difference equations of several complex variables. (Russian) **56** #16186

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**Hahn, Wolfgang** Über einige Typen nichtlinearer geometrischer Differenzengleichungen. **56** #9124

Über lineare Operatoren, die mit geometrischen Differenzen gebildet werden. **55** #6044

**Jaiyesimi, S. B.** On a difference equation of type  $1/n$ . **55** #909

**Kazeeva, N. I.** (with Tarasov, V. N.) A study of the stability of systems of difference equations in the critical case. (Russian) **56** #9125

**Kmet, Andrej** Some examples of simple difference equations. (Slovenian. English summary) **56** #9123

**Ladik, J. F.** See **Chiu, S. C.**, (**55** #1167)

**Lillo, J. C.** Almost periodic first order differential difference equations. **56** #16187

**Luca, N.** (with Talpalaru, Pavel) Stability and asymptotic behaviour of a class of discrete systems. **55** #6045

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**Andreev, V. B.** A mixed problem for the discrete Laplace equation in the half-plane. (Russian) (**56** #1739)

**Čumakov, S. A.** (with Farag, Šavki Hašem) Dirichlet problems for harmonic functions of a discrete complex argument. (Russian) **56** #16189

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**Ludescher, Helmuth** Representation of the solutions of the linear iterative equation by means of series. **55** #13112



- Matthys, J.** Linear vector recurrences. (56 #13737)  
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**de Bragança, Sérgio Luiz** Finite dimensional Baxter algebras. (56 #6464)  
**Corovei, Ilie** The cosine functional equation for nilpotent groups. (55 #8603)  
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## 40-XX SEQUENCES, SERIES, SUMMABILITY

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**Roach, F. A.** Boundedness of value regions and convergence of continued fractions. (55 #3229)

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### 40A25 Approximation to limiting values (summation of series, etc.) [For the Euler-Maclaurin summation formula, see 65B15.]

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**Cerimele, B. J.** Summation of multiparameter harmonic series. 55 #13119  
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- Borwein, David (with Kratz, W.) On the zeros of the power series  $\sum_{n=0}^{\infty} (-1)^n (1 - c^{-n-1})^k z^n$  with an application to discontinuous Riesz-summability. (**56** #3261)  
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**40Dxx Direct theorems on summability****40D05 General theorems**

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**40D10 Tauberian constants and oscillation limits**

- Rajagopal, C. T. A generalization of Tauber's theorem and some Tauberian constants. IV. **56** #911a  
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**40D15 Convergence factors and summability factors****40D20 Summability and bounded fields of methods**

- Brown, H. I. (with Crawford, J. P.; Stratton, H. H.) On summability fields of conservative operators. (**55** #13288)  
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**40D25 Inclusion and equivalence theorems**

- Ahmad, Z. U. (with Parasher, V. K.) On a relation between  $(N, p_n)$  and  $(R, 1, \alpha)$ -summability. (**56** #12698)  
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- Chandra, Prem A note on an inclusion theorem. (**56** #12696)  
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## 41-XX APPROXIMATIONS AND EXPANSIONS [For all approximation theory in the complex domain, see 30A80 and 30A82; for all trigonometric approximation and interpolation, see 42A08, 42A12.]

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## 41A05 Interpolation [See also 42A12 and 65D05.]

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**Hlobistov, V. V.** See **Berezovskii, A. I.**, **55** #930 and **Berezovskii, A. I.**, **56** #924

**Jaffe, L.** Rolle regular Birkhoff interpolation. **55** #8611

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- Milovanović, Gradimir V. (with Pečarić, Josip E.) On generalization of the inequality of A. Ostrowski and some related applications. (**56** #15853)
- Osgood, Charles F. (with Shisha, Oved) Numerical quadrature of improper integrals and the dominated integral. (**56** #7128)
- Panasovič, V. O. The remainder in a cubature formula for a sphere. (Ukrainian. English and Russian summaries) **56** #939
- Pečarić, Josip E. See Milovanović, Gradimir V., (**56** #15853)
- Pinkus, Allan See Michelli, Charles A., **56** #3528 and Michelli, Charles A., (**55** #8627)
- Pittnauer, Franz (with Reimer, Manfred) Interpolation mit Intervallfunktionalen. (**55** #4599)
- Ramazanov, M. D. Cubature formulae on spaces of continuously differentiable functions. (Russian) **56** #3529
- Reimer, Manfred See Pittnauer, Franz, (**55** #4599)
- Rowland, J. H. (with Miel, G. J.) Exit criteria for Newton-Cotes quadrature rules. (**56** #17014)
- Šarygin, I. F. An error estimate from below for the formula of approximate summability on the class  $E_{r,p}(C)$ . (Russian) (**56** #17015)
- Shisha, Oved See Osgood, Charles F., (**56** #7128)
- Storčai, V. F. See Ligun, A. A., (**55** #8624)
- Velev, G. D. Cubature formulas for singular integrals with a Hilbert kernel. (Russian) **56** #16227
- A method of estimating the error of certain quadrature and cubature formulas. (Russian) **56** #16228

- Velikin, V. L. Hermitian splines and related quadrature formulae for certain classes of differentiable functions. (Russian) **56** #9156
- Žensykhbaev, A. A. Best quadrature formula for the class  $W'L_2$ . (Russian summary) **56** #6234
- Zielas, Wolfgang ★Verallgemeinerte Interpolation und Quadraturen. (**55** #13126)

## 41A60 Asymptotic approximations, asymptotic expansions (steepest descent, etc.) [See also 30A84.]

- Adamović, Dušan D. An identity and asymptotic behaviour of some sequences. **56** #6235
- Barancev, R. G. Asymptotology. (Russian. English summary) **55** #953
- Bender, Edward A. Errata: "Asymptotic methods in enumeration" (SIAM Rev. **16** (1974), 485–515). (**55** #10276)
- Biggs, Albert W. Asymptotic approximations for surface scattering integrals. (**56** #13525)
- Bleistein, Norman Asymptotic expansions of integral transforms of functions with logarithmic singularities. **55** #13135
- Cirulidis, T. T. ★Метод градиентных линий для асимптотического представления контурных интегралов. (Russian) [The method of gradient lines for the asymptotic representation of contour integrals] **55** #6088
- Drožžinov, Ju. N. (with Zav'jalov, B. I.) Quasiasymptotic behavior of generalized functions, and Tauberian theorems in the complex domain. (Russian) **55** #8654
- (Erdélyi, A.) See Temme, N. M., **55** #6090
- Glasser, M. L. Asymptotic evaluation of an integral arising in polaron theory. **55** #954
- Heading, J. Global phase-integral methods. (**56** #16083)
- Jakovlev, Ju. S. Method of asymptotically equivalent functions. (**56** #985)
- Jansons, J. See Rieksins, E., **56** #6236
- Kaper, Hans G. Asymptotic evaluation of two families of integrals. **55** #13136
- Olver, F. W. J. ★Asymptotics and special functions. **55** #8655
- Pankoke, Hans-Joachim Anwendung einer verallgemeinerten Laplace-Transformation auf asymptotische Entwicklungen. **56** #3530
- Riedel, Roland Zur Methode der stationären Phase. **55** #6089
- Rieksins, V. Uniform asymptotic expansion of a certain class of integrals. (Russian) **56** #3532
- Uniform asymptotic expansion of a certain class of integrals in the case of a multiple critical point. (Russian) **56** #3533
- Rieksins, E. A generalization of the saddle point method. (Russian) **56** #3531
- (with Jansons, J.) Asymptotic expansion of integrals with periodic kernels. (Russian) **56** #6236
- Schell, Hans-Joachim Eine explizite Restgliedabschätzung für asymptotische Entwicklungen von Parameterintegralen. **55** #955
- Schumacher, Martin ★Über asymptotische Potenzreihen in zwei Veränderlichen und ein zweidimensionales Momentenproblem. **56** #16229
- Temme, N. M. Remarks on a paper of A. Erdélyi: "Asymptotic evaluation of integrals involving a fractional derivative" (SIAM J. Math. Anal. **5** (1974), 159–171). **55** #6090
- Zav'jalov, B. I. See Drožžinov, Ju. N., **55** #8654
- Zil'bergleit, A. S. Uniform asymptotic expansions of certain definite integrals. (Russian) **55** #10931

## 41A63 Multidimensional problems

- Babaev, M.-B. A. Approximation of functions of three variables by sums of functions of two variables. (Russian. Georgian and English summaries) **56** #12734
- Gordon, William J. (with Wixom, James A.) Shepard's method of "metric interpolation" to bivariate and multivariate interpolation. **56** #16230
- Hartley, P. J. Tensor product approximations to data defined on rectangular meshes in  $N$ -space. (**56** #4119)
- Kononov, V. M. Approximation characterizations of Weierstrass theorem type for functions of several variables. (Ukrainian. English and Russian summaries) **56** #940
- Kytmanov, A. M. (with Preobraženskii, A. A.) On a problem about the density of the polynomials of a definite form in the space of continuous functions on the boundary of the domain in  $C^n$ . (Russian) (**56** #5941)
- Prenter, P. M. On error estimates for Lagrange polynomials on the triangle. **55** #6091
- Preobraženskii, A. A. See Kytmanov, A. M., (**56** #5941)
- Reimer, Manfred On multivariate polynomials of least deviation from zero on the unit ball. **56** #3534
- Wixom, James A. See Gordon, William J., **56** #16230

## 41A65 Abstract approximation theory (approximation in normed linear spaces and other abstract spaces)

- Abatzoglou, Theagenis On the minimum norm projection on closed subspaces of  $L^p[0, 2\pi]$  and an application. **56** #12735
- Albinus, G. Approximationstheorie im Raum  $C(R)$ . **55** #8657
- Aliiev, B. I. See Džafarov, A. S., **55** #3646
- Anselone, P. M. ★Collectively compact operator approximation theory and applications to integral equations. (**56** #1753)
- Theory of approximation by collectively compact operators, and its application to the transport equation. (Russian) (**56** #16409)
- Arend, W. Zur Einschliessung der Minimalabweichung in metrisierbaren lokalkonvexen Räumen. **55** #13137
- Arestov, V. V. On the best approximation of the operators of differentiation and related questions. **56** #9157
- Bauer, Heinz Approximationssätze und abstrakte Ränder. (**56** #12723)
- Baumeister, Johann (with Schumaker, L. L.) Nonlinear classes of splines and variational problems. **55** #8658
- Beauzamy, Bernard (with Maurey, Bernard) Points minimaux et ensembles optimaux dans les espaces de Banach. (**55** #1044)



- Berdyšev, V. I.** Metric projection onto finite-dimensional subspaces from  $C$  and  $L$ . (Russian) **55** #956
- Bhola, H. L.** *See* **Sharma, P. L.**, **55** #3649
- Blatter, Jörg** (*with* **Seever, G. L.**) Interposition and lattice cones of functions. (55 #11013)
- Bragard, G. K.** (*with* **Nessel, R. J.**) A local comparison theorem with applications to approximation in certain group and multiplier algebras. (Russian summary) **55** #10932
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- (Butzer, P. L.)** *See* **Sjögren, Peter**, **56** #12739
- Chalmers, Bruce L.** (*with* **Metcalfe, F. T.**) On the computation of minimal projections from  $C[0, 1]$  to  $P_n[0, 1]$ . **56** #3535
- Chevalier, Georges** Sur quelques applications de la notion de système de Tchebycheff au sens de Bernstein. (English summary) **55** #13138
- Chui, Charles K.** (*with* **Smith, Philip W.**; **Ward, J. D.**) Quasi-uniqueness in  $L^\infty$  extremal problems. **56** #941
- Ciesielski, Z.** Bases and approximation by splines. (56 #1041)
- (Davis, Joel)** *See* **Anselone, P. M.**, (56 #1753)
- Delvos, F.-J.** (*with* **Posdorf, H.**) On optimal tensor product approximation. **55** #10933
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- Dierieck, C.** Simultaneous approximation of vector-valued functions. **55** #3645
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- Edelstein, Michael** Weakly proximinal sets. **55** #10934
- Fakhoury, Hicham** Approximation des bornés d'un espace de Banach par des compacts et applications à l'approximation des opérateurs bornés. (English summary) (56 #16323)
- Fehér, Franziska** Approximationssätze auf rearrangement-invarianten Banach-Räumen über dem Torus. **56** #16232
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- de la Fuente, Angel** The Weierstrass-Stone theorem for Clifford and Cayley-Dickson algebras. **56** #9158
- Gabusin, V. N.** On the problem of the best approximation of operators. (Russian) (56 #16412)
- Godini, G.** On set-valued mappings. **56** #942
- Grossman, Marvin W.** Lototsky-Schnabl functions on compact convex sets. **56** #6237
- Hausmann, W.** (*with* **Pottinger, Peter**) On the construction and convergence of multivariate interpolation operators. **55** #6093
- Holmes, R. B.**  $M$ -ideals in approximation theory. **55** #957
- Istrătescu, Vasile I.** A Weierstrass theorem for real Banach spaces. **56** #6238
- Kenderov, P. S.** Points of single-valuedness of multivalued metric projections. **55** #958
- Lambert, Joseph M.** Conditions for simultaneous approximation and interpolation with norm preservation in  $C[a, b]$ . **55** #3647
- Light, William A.** Norms of some projections on  $C[a, b]$ . **56** #16233
- Löfström, Jörgen** Local convergence of convolution integral. **55** #10935
- Lorentz, Rudolph A.** ★Positive approximation. **56** #9159
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- Machado, Silvio** (*with* **Prolla, João B.**) Concerning the bounded case of the Bernstein-Nachbin approximation problem. **56** #6239
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- Metcalfe, F. T.** *See* **Chalmers, Bruce L.**, **56** #3535
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- Milman, Pierre D.** On best simultaneous approximation in normed linear spaces. **56** #943
- Milota, Jaroslav** Minimal interpolation in a normed linear space. **55** #8660
- Motornyi, V. P.** (*with* **Ruban, V. I.**) Diameters of certain classes of differentiable periodic functions in the space  $L$ . (Russian) **56** #3536
- Müller, Manfred W.** Sätze vom Bohman-Korovkin-Typ für Banachsche Funktionenräume. **55** #10937
- Nagy, B.** Approximation theorems for cosine operator functions. (55 #13294)
- Nessel, R. J.** *See* **Bragard, G. K.**, **55** #10932 and **Sjögren, Peter**, **56** #12739
- Orno, Peter** A separable reflexive Banach space having no finite dimensional Čebyšev subspaces. **56** #12736
- Ost, F.** *See* **Fischer, H.**, (56 #13547)
- Paulik, Augustin** On the optimal approximation of bounded linear functionals in Hilbert spaces with inner product invariant in rotation or translation. (55 #11610)
- Pinkus, Allan** *See* **Micchelli, Charles A.**, **55** #3648
- Pollul, Walter** ★Reflexivität und Existenz-Teilräume in der linearen Approximationstheorie. **56** #3537
- Posdorf, H.** *See* **Delvos, F.-J.**, **55** #10933
- Pottinger, Peter** Polynomoperatoren in  $C^k[a, b]$ . (English summary) **55** #13140  
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- Příkrýl, Petr** Universal simultaneous approximations of the coefficient functionals. (Czech and loose Russian summaries) **56** #12737
- Prolla, João B.** Dense approximation for polynomial algebras. (56 #12859)  
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- Rusk, Michael D.** Determining sets and Korovkin sets on the circle. **56** #6240
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- Sharma, P. L.** (*with* **Bhola, H. L.**) Measure of best approximation in non-Archimedean quasi normed spaces. **55** #3649
- Sjögren, Peter** Approximation dans les espaces de Banach et mesures spectrales. **56** #12739
- Šmatkov, V. A.** Simultaneous approximation and interpolation problems. (Russian) **56** #9160
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- Stachowiak-Gniłka, Danuta** The generalized Weierstrass theorem in the class  $\varphi^+(L)$ . **56** #6241
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- Ward, J. D.** *See* **Chui, Charles K.**; et al., **56** #941
- Wegmann, Rudolf** Bounds for nearly best approximations. **56** #944
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- Wulbert, Daniel** An approximation proof in the theory of complex  $L_1$ -preduals. (55 #1052)
- van Wyk, D. J.** (*with* **Roode, J. D.**) An algorithm for continuous linear Chebyshev approximation. (55 #13738)
- Zamansky, Marc** Approximation in a normed space. New foundations and methods. **55** #8662

## 42-XX FOURIER ANALYSIS

- Gibbs, J. E.** "Instant" Fourier transform. **56** #6243
- Staffans, Olof J.** Positive definite measures with applications to a Volterra equation. (56 #16289)

### 42-01 Elementary exposition (collegiate level)

- Descombes, Roger** ★Intégration. (55 #12890)
- Hönl, Chaim S.** ★Análise funcional e o problema de Sturm-Liouville. (Portuguese) [Functional analysis and the Sturm-Liouville problem] (55 #8727)

### 42-02 Advanced exposition (research surveys, etc.)

- Dym, Harry** (*with* **McKean, Henry P.**) ★Fourier series and integrals. **56** #945
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### 42-03 Historical

- Fefferman, Ch.** (*with* **Kahane, Jean-Pierre**; **Stein, E. M.**) The scientific achievements of Antoni Zygmund. (Polish) **55** #6094
- Kahane, Jean-Pierre** *See* **Fefferman, Ch.**; et al., **55** #6094
- Stein, E. M.** *See* **Fefferman, Ch.**; et al., **55** #6094
- Zygmund, Antoni** Notes on the history of Fourier series. **56** #12740  
*See also* **Fefferman, Ch.**; et al., **55** #6094
- Bibliography:**  
**Zygmund, Antoni** *See* **Fefferman, Ch.**; et al., **55** #6094  
**Theses completed under A. Zygmund** *See* **Fefferman, Ch.**; et al., **55** #6094

### 42-04 Explicit machine computation and programs (not the theory of computation or programming)

### 42-06 Collections of papers; proceedings of conferences

- (Ash, J. Marshall)** *See* **Studies in harmonic analysis**, **56** #946
- (Mitjagin, B. S.)** *See* **Mathematical programming and related questions**, (55 #16)
- Conference:**  
**Harmonic Analysis** *See* **Studies in harmonic analysis**, **56** #946
- Functional analysis** *See* **Mathematical programming and related questions**, (55 #16)
- Harmonic analysis** *See* **Studies in harmonic analysis**, **56** #946
- Mathematical programming and related questions** ★Математическое программирование и смежные вопросы (Труды сельской зимней школы, Дрогобыч, 1974). (Russian) [Mathematical programming and related questions (Proceedings of the Seventh Winter School, Drogobych, 1974)] (55 #16)
- Proceedings:**  
**Winter School on Mathematical Programming and Related Questions** *See* **Mathematical programming and related questions**, (55 #16)
- Studies in harmonic analysis** ★Studies in harmonic analysis. **56** #946
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**Mathematical Programming and Related Questions** *See* **Mathematical programming and related questions**, (55 #16)

## 42A04 Trigonometric polynomials, inequalities, extremal problems

- Osval'd, P.** Some inequalities for trigonometric polynomials in the  $L_p$  metric,  $0 < p < 1$ . (Russian) **56** #12741
- Pak, I. N.** Roots and their bounds for sums of a class of general trigonometric series. (Russian) **56** #12742



- Stark, Eberhard L. Inequalities for trigonometric moments and for Fourier coefficients of positive cosine polynomials in approximation. 55 #10938
- Trigub, R. M. The integral norms of polynomials. (Russian) 55 #3652

## 42A08 Approximation by trigonometric polynomials

- Baskakov, V. A. Certain properties of operators of Abel-Poisson type. (Russian) 56 #3540
- On the order of approximation of continuous and differentiable functions by irregular summation methods for Fourier series. (Russian) 56 #16235
- Butzer, P. L. (with Dyckhoff, H.; Görlich, E.; Stens, R. L.) Best trigonometric approximation, fractional order derivatives and Lipschitz classes. 56 #947
- Dyckhoff, H. See Butzer, P. L.; et al., 56 #947
- Dym, Harry (with McKean, Henry P.) ★Gaussian processes, function theory, and the inverse spectral problem. (56 #6829)
- Džafarov, Arif S. The convergence and order of convergence of a family of positive linear integral operators on the sphere. (Russian. Azerbaijani and English summaries) 56 #948
- Efimov, A. V. (with Filimonova, V. A.) The approximation of conjugate functions by conjugate interpolation sums. (Russian) 55 #3653
- Falaleev, L. P. Approximation of functions by polynomials that are best on a given system of points. (Russian) 56 #9161
- Filimonova, V. A. See Efimov, A. V., 55 #3653
- Görlich, E. (with Stark, Eberhard L.) A unified approach to three problems on approximation by positive linear operators. (56 #6226)
- (with Nessel, R. J.; Trebels, Walter) Zur Approximationstheorie für Summationsprozesse von Fourier-Entwicklungen in Banach-Räumen: Vergleichssätze und Ungleichungen vom Bernstein-Typ. (English summary) (56 #9169)
- See also Butzer, P. L.; et al., 56 #947
- Johnson, Darell J. Nonuniqueness of simultaneous approximation by trigonometric polynomials. 55 #8663
- Judin, V. A. A multidimensional Jackson theorem. (Russian) 56 #949
- Kibalko, P. I. The approximation of periodic functions of two variables by a class of linear methods for the summability of double Fourier series. (Russian) 56 #3541
- Kirov, G. H. Approximation of functions of two variables by generalized Bernstein-Rogosinski sums. (Russian) 56 #9162
- Kogan, D. A. Questions on the approximation of functions by linear operators that are obtained by means of  $r$ -tuple convolution. (Russian) 55 #959
- Koljada, V. I. Imbedding theorems and inequalities of various metrics for best approximations. (Russian) 56 #12743
- Korničuk, M. P. ★Экстремальные задачи теории приближения. (Russian) [Extremal problems of approximation theory] 56 #6244
- Kroó, A. V. The problem of correctness of best approximations by trigonometric polynomials of the class  $W_2^r H[\omega]_C$ . (Russian) 56 #6245
- Leindler, L. On strong approximation of Fourier series. 56 #9163
- On the strong approximation of Fourier series. 55 #6095
- Łenski, Włodzimierz Generalizations of two Leindler's theorems. 56 #3542
- Lipovik, V. V. Approximation in the strong sense by Fourier-Čebyšev sums. (Russian) 56 #6246
- Approximation in the strong sense by truncated Fourier integrals. (Russian) 56 #6247
- Malozemov, V. N. ★Совместное приближение функции и ее производных. (Russian) [Simultaneous approximation of a function and its derivatives] (56 #929)
- McKean, Henry P. See Dym, Harry, (56 #6829)
- Mohammadzadeh, M. See Siddiqui, A. H., (56 #977)
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- Rempulka, Lucyna See Olejnik, Dorota, 56 #16236
- Rvačev, V. A. Approximation by means of the function  $up(x)$ . (Russian) (56 #6218)
- Rybnikova, T. I. On a method for the approximation of periodic functions satisfying a Lipschitz condition. (Russian) 56 #6250
- Sevast'janov, E. A. Piecewise monotone and rational approximation and uniform convergence of Fourier series. (Russian) 55 #3654
- Siddiqui, A. H. (with Mohammadzadeh, M.) Approximation by Cesaro and  $B$  means of double Fourier series. (56 #977)
- Stark, Eberhard L. See Görlich, E., (56 #6226)
- Stens, R. L. See Butzer, P. L.; et al., 56 #947
- Stepanec, O. I. Approximation of periodic functions of Hölder classes by Riesz sums. (Russian) 56 #9164
- Storoženko, E. A. (with Oswald, P.) Moduli of smoothness and best approximation in the spaces  $L^p$ ,  $0 < p < 1$ . (Russian summary) (56 #6219)
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- Taberski, Toman On the Riesz means of Fourier-Bessel series. 56 #6254
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- Some estimates for functions of two variables. 56 #951
- Taikov, L. V. Inequalities containing best approximations, and the modulus of continuity of functions in  $L_2$ . (Russian) 55 #960
- Temirgaliev, N. The imbedding of certain classes of functions. (Russian) 56 #952
- Temirjakov, V. N. The localization of approximations of functions by trigonometric

- polynomials. (Russian. English summary) 56 #12744
- Timan, A. F. (with Trofimov, V. N.) The exact constants in certain inverse theorems for approximations by trigonometric polynomials. (Russian) 56 #9166
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- Timmermans, C. A. Modulus of continuity for periodic functions. 56 #9167
- Trebels, Walter See Görlich, E.; et al., (56 #9169)
- Trofimov, V. N. See Timan, A. F., 56 #9166
- Vasil'ev, R. K. Order of the approximation of functions on sets by polynomial operators of class  $S_m$ . (Russian) (55 #10925)
- Veler, G. D. Cubature formulas for singular integrals with a Hilbert kernel. (Russian) (56 #16227)
- A method of estimating the error of certain quadrature and cubature formulas. (Russian) (56 #16228)
- Žuk, V. V. Some inequalities for the best approximation of periodic functions. (Russian. English summary) 56 #16237
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- Some sharp inequalities between best approximations and higher order moduli of continuity. (Russian) 56 #6255
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- Theory of Approximation of Functions See Vasil'ev, R. K., (55 #10925); Efimov, A. V.; et al., 55 #3653; Taikov, L. V., 55 #960; Judin, V. A., 56 #949 and Sevast'janov, E. A., 55 #3654

## 42A12 Trigonometric interpolation

- Forst, Wilhelm Optimale Hermite-Interpolation differenzierbarer periodischer Funktionen. (English summary) (56 #12701)
- Güntner, R. Eine optimale Fehlerabschätzung zur trigonometrischen Interpolation. 55 #8664
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45-02 Advanced exposition (research surveys, etc.)

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- 45E10 Integral equations of the convolution type (Abel, Picard, Toeplitz and Wiener-Hopf type) [See also 44A15, 44A35, 47B35.]
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- Bownds, John M.** On solving weakly singular Volterra equations of the first kind with Galerkin approximations. (55 #11654a)  
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- Edelstein, Warren S.** On uniqueness of solutions for nonlinear creep problems in symmetric pressure vessels. **56** #3598
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- Bainov, Drumi D.** (with Miluševa, S. D.) A certain variant of the averaging method that is applicable to a nonlinear two-point boundary value problem for systems of integro-differential equations of Volterra type. (Russian. Polish and English summaries) **56** #9207  
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- Bantaş, Gh.** Équations intéro-fonctionnelles de Volterra à solutions dans certains espaces de fonctions réglées. **55** #13191
- Bhonsle, B. R.** (with Muley, D. B.) Study of integro-differential equation  $(d/dt)u(t, \lambda) + \lambda \int_0^t a(t-s)u(s, \lambda) ds = 0$ ,  $u(0, \lambda) = 1$ . **56** #12797
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- Kim, Se Gŭn** On solutions of integro-differential equation and differential equation (Korean. English summary) **55** #6151
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- Krivošeín, L. E.** (with Leung, Kin-Vinh; Mangeron, Dumitru Ion; Oğuztörelí, Mehmet Namık) Systèmes différentiels possédant la structure complexe. Problèmes de type Goursat aux conditions intégrales à la frontière concernant une classe d'équations intégrodiférentielles non linéaires aux dérivées totales de Picone. (English summary) **55** #13196  
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- Subinin, M. F.** An integrodifferential equation. (Russian) **55** #8721
- Tihonov, A. N.** A uniqueness theorem for a certain partial differential equation of fractional order. (Russian) (56 #3435)
- Ukai, Seiji** Les solutions globales de l'équation de Boltzmann dans l'espace tout entier et dans le demi-espace. (English summary) (56 #3482)
- Vedenjapin, V. V.** The uniqueness of the Boltzmann  $H$ -function. (Russian) **55** #13201
- Wheeler, Robert L.** See Miller, Richard K., **55** #13200
- Wörle, Helmut** See Balli, Raffaele; et al., **55** #8719
- Žemuhov, H. K.** The Darboux problem for a certain degenerate integro-differential equation. (Russian. English summary) **55** #1013

#### 45Lxx Approximation of solutions

- Anselone, P. M.** ★Collectively compact operator approximation theory and applications to integral equations. (56 #1753)  
(Davis, Joel) See Anselone, P. M., (56 #1753)

#### 45L05 Theoretical approximation of solutions

- Boglaev, Ju. P.** An iteration method for the approximate solution of singularity perturbed Volterra integral equations. (Russian) **55** #1014
- Brunner, Hermann** Discretization of Volterra integral equations of the first kind. (56 #10076)
- Ėfendieva, O. A.** The solution of linear extremal-integral equations of Volterra type by means of a certain variant of Ju. D. Sokolov's method. (Russian. Azerbaijani summary) **56** #6319
- Farag, Šavki Hašem** A method for the numerical solution of singular integral equations that are connected to the Schwarz operator for annular domains. (Russian) (55 #12905)
- Friedrich, Volkmar** Zu einigen Verfahren der numerischen Behandlung nichtkorrekter Aufgaben. (55 #1756)
- Golovač, G. P.** (with Kalaïda, O. F.) The rate of convergence of iterative methods for the solution of linear integral equations of Volterra type. (Ukrainian. English and Russian summaries) **56** #6320
- Hussein, M. Ī.** The approximation of the solutions of nonlinear integral equations of Hammerstein type in the space  $L_p$ . (Ukrainian. English and Russian summaries) **56** #6321
- Kalaïda, O. F.** See Golovač, G. P., **56** #6320
- Ko, Jae Ha** On the approximate solution of boundary value problems for integro-differential equations. (Korean. English summary) **56** #1002
- Kolosov, A. I.** (with Li, Mung Su) The two-sided convergence of the method of successive approximations. (Russian) (56 #17168)
- Li, Mung Su** See Kolosov, A. I., (56 #17168)
- Lifanov, I. K.** (with Polonskii, Ja. E.) Proof of the numerical method of "discrete vortices" for solving singular integral equations. (55 #9580)
- Lovelady, David Lowell** Perturbations of solutions of Stieltjes integral equations. **55** #6154
- Parezanović, Nedeljko S.** Solution of a Fredholm integral equation by means of differential equations. (Serbo-Croatian. English summary) **55** #6155
- Polonskii, Ja. E.** See Lifanov, I. K., (55 #9580)
- Stummel, Friedrich** Perturbations of non-linear integral operators. **56** #9210
- Zolotarevskii, V. A.** Convergence of the collocation method and of the method of mechanical quadratures for systems of singular integral equations. (Russian) en(56 #10083)
- 45L10** Numerical approximation of solutions [For numerical analysis, see 65R05.]
- Gorlov, V. E.** The approximate solution of nonlinear singular integral equations. (Russian) **56** #16305
- Krenk, Steen** On quadrature formulas for singular integral equations of the first and the second kind. (56 #7272)
- Sloan, Ian H.** Convergence of degenerate-kernel methods. (56 #10079)
- Wang, J. Y.** On the numerical computation of eigenvalues and eigenfunctions of compact integral operators using spline functions. **55** #8722

#### 45Mxx Qualitative behavior

##### 45M05 Asymptotics

- Burkitbaev, Ž. I.** Asymptotic behavior of the solution of a singular boundary value problem for a singularly perturbed system of linear integrodifferential equations of



- Fredholm type. (Russian. Kazakh summary) **56** #16306  
**Freiria, A. A.** See **Izé, A. F.**, **55** #8723  
**Imanaliyev, M. I.** A general asymptotic theory of systems of nonlinear integro-differential equations of Volterra type with a small parameter multiplying the highest derivative and with integral initial data. (Russian) **56** #12801  
**Izé, A. F.** (with **Freiria, A. A.**) Asymptotic behavior and non oscillation of Volterra integral equations. **55** #8723  
**London, Stig-Olof** On the asymptotic behavior of the bounded solutions of a nonlinear Volterra equation. (**56** #16287)  
**Miller, Richard K.** Some Volterra integral equations of growth rate type. (Polish and Russian summaries) **56** #16307  
**Pachpatte, B. G.** On the asymptotic behavior of functional integrodifferential equations. **55** #3719  
 Stability and asymptotic behavior of perturbed Volterra integral equations. **56** #9211  
**Staffans, Olof J.** Positive definite measures with applications to a Volterra equation. (**56** #16289)  
**Trubin, V. G.** Asymptotic behavior of the solution of the Cauchy problem for a degenerate integro-differential equation with a small parameter multiplying the derivative. (Russian) **56** #16308  
**Ved', Ju. A.** Asymptotic properties of the solutions of equations with after effect. (Russian) **56** #3604  
**Voronoi, O. M.** The construction of an asymptotic solution for a system of linear integrodifferential equations with a small parameter multiplying the derivative. (Russian. English summary) **55** #1015  
**Werbowski, Jarosław** An estimation of the solution of the system of nonlinear equations of Volterra type with delay. (Polish summary) **56** #6322

#### 45M10 Stability theory

- Muszyński, Jerzy** Behaviour of solutions of an integral equation. (Loose Russian summary) **56** #3605  
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#### 45M99 None of the above, but in this section

- Filatov, A. N.** Методы усреднения в дифференциальных и интегро-дифференциальных уравнениях. (Russian) [Averaging methods in differential and integro-differential equations] **56** #3606  
**Ramm, A. G.** Correction: "A study of a certain class of integral equations" (Dokl. Akad. Nauk SSSR **230** (1976), no. 2, 283–286). (Russian) **55** #1016

### 45N05 Abstract integral equations, integral equations in abstract spaces

- Aizicovici, Sergiu** Abstract integral equations of Volterra type. **55** #8724  
**Konstantinov, Mihail M.** The application of a norm with weight in existence and uniqueness theorems for the solutions of functional equations in a Banach space with an unknown function that depends on several arguments. (Russian) (**56** #1153)  
**Lightbourne, James H., III** Periodic solutions and perturbed semigroups of linear operators. (**56** #16466)  
**Linnik, I. Ju.** The canonical distribution of a class of Toeplitz operators on a locally compact abelian group. (Russian) **55** #3722  
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**Solomon, Sender** A theorem of existence and uniqueness for an integral equation in topological spaces. **55** #8725  
 On some integral equations in topological spaces. (**56** #9200)

### 46–XX FUNCTIONAL ANALYSIS [For manifolds modelled on topological linear spaces, see 57A20, 58Bxx.]

#### 46–01 Elementary exposition (collegiate level)

- Akilov, G. P.** See **Kantorovič, L. V.**, (**56** #16402)  
**Cristescu, Romulus** ★Topological vector spaces. **56** #12802  
**Fomin, S. V.** See **Kolmogorov, A. N.**, **56** #6323 and **Kolmogorov, A. N.**, **55** #8728  
 (Freitag, Dietrich) See **Kolmogorov, A. N.**; et al., **56** #6323  
 (Gorin, E. A.) See **Rudin, Walter**, **56** #16309  
**Grossmann, Siegfried** ★Funktionalanalysis. I, II: Im Hinblick auf Anwendungen in der Physik. **55** #8726  
 (Helle, Renate) See **Smirnov, V. I.**, (**55** #5807)  
**Hoffman, Kenneth** ★Analysis in Euclidean space. (**56** #12186)  
**Hönl, Chaim S.** ★Análise funcional e o problema de Sturm-Liouville. (Portuguese) [Functional analysis and the Sturm-Liouville problem] **55** #8727  
**Hudjaev, S. I.** See **Vol'pert, A. I.**, (**55** #903)  
**Kantorovič, L. V.** (with **Akilov, G. P.**) ★Funktionalanalysis in normierten Räumen. (**56** #16402)  
**Kolmogorov, A. N.** (with **Fomin, S. V.**) ★Reelle Funktionen und Funktionalanalysis. **56** #6323  
 (with **Fomin, S. V.**) ★Элементы теории функций и функционального анализа. (Russian) [Elements of the theory of functions and functional analysis] **55** #8728  
**Kudrewicz, Jacek** ★Analiza funkcjonalna dla automatyków i elektroników. (Polish) [Functional analysis for control engineers and electrical engineers] **56** #9212  
**Kufner, Alois** ★Geometrie Hilbertova prostoru. (Czech) [The geometry of Hilbert space] **55** #10988  
 (Kühne, Rolf) See **Kantorovič, L. V.**; et al., (**56** #16402)

- (**Langer, Heinz**) See **Kantorovič, L. V.**; et al., (**56** #16402)  
 (Lin, V. Ja.) See **Rudin, Walter**, **56** #16309  
 (Mai, Brigitte) See **Smirnov, V. I.**, (**55** #5807)  
**Meissl, P.** Elements of functional analysis. **55** #8729  
 (Müller, P. Heinz) See **Kantorovič, L. V.**; et al., (**56** #16402)  
 (Palme, H.) See **Kolmogorov, A. N.**; et al., **56** #6323  
**Rudin, Walter** ★Функциональный анализ. (Russian) [Functional analysis] **56** #16309  
**Schechter, Martin** ★Principles of functional analysis. **56** #3607  
**Šilov, G. E.** An introduction to the theory of linear spaces. (**55** #8058)  
 (Silverman, Richard A.) See **Šilov, G. E.**, (**55** #8058)  
**Smirnov, V. I.** ★Lehrgang der höheren Mathematik, Teil V. (**55** #5807)  
 (Stöckert, B.) See **Kolmogorov, A. N.**; et al., **56** #6323  
 (Suliciu, Mihaela) See **Cristescu, Romulus**, **56** #12802  
**Voigt, Alexander** (with **Wloka, Joseph**) ★Hilberträume und elliptische Differentialoperatoren. **56** #12803  
**Vol'pert, A. I.** (with **Hudjaev, S. I.**) ★Анализ в классах разрывных функций и уравнения математической физики. (Russian) [Analysis in classes of discontinuous functions, and the equations of mathematical physics] (**55** #903)  
**Wloka, Joseph** See **Voigt, Alexander**, **56** #12803

#### 46–02 Advanced exposition (research surveys, etc.)

#### 46–03 Historical

#### 46–04 Explicit machine computation and programs (not the theory of computation or programming)

#### 46–06 Collections of papers; proceedings of conferences

- (**Amanov, T. I.**) See **Imbedding theorems and their applications**, **56** #9214  
 (Baker, J.) See **Banach spaces of analytic functions**, **56** #1004  
 (Bierstedt, Klaus-Dieter) See **Functional analysis: surveys and recent results**, **56** #12805  
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 (Krein, S. G.) See **Collection: Applications of functional analysis**, **55** #3723  
 (Mitjagin, B. S.) See **Proceedings: Winter School on Mathematical Programming and Related Questions**, (**55** #13)  
 (Morrel, Bernard B.) See **K-theory and operator algebras**, (**56** #15254)  
 (Nikol'skii, S. M.) See **Imbedding theorems and their applications**, **56** #9214  
 (Singer, I. M.) See **K-theory and operator algebras**, (**56** #15254)  
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**All-Union Symposium:**  
 Imbedding Theorems and their Applications See **Imbedding theorems and their applications**, **56** #9214  
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**Approximation theory in functional analysis** ★Approximation theory in functional analysis. **56** #1003  
**Athens, Ga.** See **K-theory and operator algebras**, (**56** #15254)  
**Banach spaces of analytic functions** ★Banach spaces of analytic functions. **56** #1004  
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**Collection:**  
 Applications of functional analysis ★Сборник научных статей по приложениям функционального анализа. (Russian) [Collection of articles on applications of functional analysis] **55** #3723  
**Conference:**  
**Function Spaces and Dense Approximation** See **Function spaces and dense approximation**, **56** #1005  
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**Pelczynski, Banach Spaces of Analytic Functions** See **Banach spaces of analytic functions**, **56** #1004  
**Convex analysis** See **Travaux: Séminaire d'Analyse Convexe**, **55** #3724  
**Dense approximation** See **Function spaces and dense approximation**, **56** #1005  
**Function algebras** See **Special issue: Function algebras and their applications**, **56** #9213  
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**Functional analysis** ★Функциональный анализ. Вып. 2. (Russian) Functional analysis. No. 2 **55** #6156  
 ★Funktional'nyi analiz. Vyp. 3. (Russian) [Functional analysis. No. 3] **55** #8730  
**Functional analysis and its applications** See **Proceedings: Winter School on Mathematical Programming and Related Questions**, (**55** #13)  
**Functional analysis: surveys and recent results** ★Functional analysis: surveys and recent results. **56** #12805  
**Geometry of Banach spaces** See **Séminaire: Maurey-Schwartz**, **56** #12804  
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**Proceedings:**

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## 46Axx Topological linear spaces

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Nonselfadjoint operators *★*Несамосопряженные операторы. (Russian) [Nonselfadjoint operators] 55 #3821

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Proceedings:

Winter School on Mathematical Programming and Related Questions *★*Труды Шестой Зимней Школы по Математическому Программированию и Смежным Вопросам (г. Дрогобыч, январь 1973 г.). (Russian) [Proceedings of the Sixth Winter School on Mathematical Programming and Related Questions (Droboych, January 1973)] (55 #13)

*See also* Mathematical programming and related questions, (55 #17)

School:

Mathematical Десятая математическая школа (пос. КапиевельНальчик, 1972 г.). (Russian) [Tenth Mathematical School (Kaciveli/Nalchik, 1972)] (56 #15261)

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- Kiselev, A. I.** See **Krasnov, M. L.**; et al., 55 #1177
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Leray, Jean Sul problema di Dirichlet quasi lineare del secondo ordine. (55 #8548)

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Massari, Umberto (with Pepe, Luigi) Su di una formulazione variazionale del problema dei capillari in assenza di gravità. (English summary) 56 #1185

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49F15 Morse theory in Hilbert and other spaces [See also 58Exx.]

49F20 Geometric measure and integration theory, integral and normed currents, flat chains and cochains, varifolds [See also 58A25.]

Cassa, Antonio The topology of the space of positive analytic cycles. (Italian summary) (56 #662)

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Lawson, H. Blaine, Jr. The question of holomorphic carriers. (56 #8898)

Paur, Sandra O. An estimate of the density at the boundary of an integral current modulo  $v$ . (56 #13246)

49F22 Existence and structure of solutions to variational problems in geometric measure-theoretic setting

Allard, William K. Some recent advances in the multidimensional parametric calculus of variations. 55 #3932

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Hardt, Robert M. Uniqueness of nonparametric area minimizing currents. (56 #9441)

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49F25 Surface area

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49F99 None of the above, but in this section

Ashby, N. (with Brittin, W. E.; Love, W. F.; Wyss, W.) Brachistochrone with Coulomb friction. 56 #9442

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Clarke, Frank H. Multiple integrals of Lipschitz functions in the calculus of variations. 56 #9443

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## 49Gxx Variational methods and eigenvalues

49G05 Variational approach to eigenvalues

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Binding, Paul (with Browne, Patrick J.) A variational approach to multiparameter eigenvalue problems for matrices. 56 #13105

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49G10 Rayleigh-Ritz methods

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Filippi, Paul Wave phenomena in inhomogeneous media. 56 #16508

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49G15 Weinstein and Aronsajn methods, intermediate problems

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49G20 Linear operators in Hilbert spaces

Flemming, Uwe Fehlerabschätzungen für Näherungseigenwerte und -eigenvektoren bei der Pseudostöriteration. (56 #17058)



- Kučera, Milan** A new method for the obtaining of eigenvalues of variational inequalities of the special type (preliminary communication). (55 #8860)
- Langer, Ulrich** Untersuchungen zum Kummerschen Verfahren zur numerischen Behandlung nichtlinearer Eigenwertaufgaben. (56 #3663)
- Sharma, C. S.** (with SriRankanathan, S.) A coordinate-free treatment of the minimax and maxmini theorems for eigenvalues of self-adjoint operators on a Hilbert space. (55 #6224)
- SriRankanathan, S.** See **Sharma, C. S.**, (55 #6224)

49G99 None of the above, but in this section

- Barnsley, Michael F.** (with Robinson, Peter D.) Bivariational bounds associated with non-self-adjoint linear operators. (56 #3675)
- Fichera, Gaetano** Approximation of the eigenvectors of a positive compact operator and estimate of the error. (Italian summary) (55 #6222)
- Gregory, John** Comparison theorems for oscillation of nonlinear, non-self-adjoint equations by use of quadratic forms. (56 #8971)
- Huseyin, K.** (with Plaut, R. H.) Extremum properties of the generalized Rayleigh quotient associated with flutter instability. (55 #3432)
- Jähnig, Jürgen** Qualitative Untersuchungen einer allgemeinen Verfahrensklasse zur näherungsweise Eigenwert- und Eigenvektorberechnung. (56 #13601)
- Plaut, R. H.** See **Huseyin, K.**, (55 #3432)
- Robinson, Peter D.** See **Barnsley, Michael F.**, (56 #3675)

## 49H05 Variational principles of physics [See also 70Hxx, 81A09.]

- Acker, Andrew** Isoperimetric inequalities involving heat flow under linear radiation conditions. (56 #3467)
- Anderson, N.** (with Arthurs, A. M.) Complementary variational principles for the problem of the equilibrium of a circular membrane. 56 #3733
- Arthurs, A. M.** (with Duggan, R. C.) Error bounds for variational solutions of the nonlinear Föppl-Hencky equation. (56 #17099)

- (with Walsh, G. R.) An isoperimetric problem. 56 #1188
- (with Duggan, R. C.) Dual extremum principles and the hypercircle for bi-harmonic problems. 56 #3734
- Variational formulation of Hamiltonian boundary value problems. 56 #16509
- See also **Anderson, N.**, 56 #3733
- Duffin, R. J.** (with Karlovitz, L. A.) Orbits of most action on a convex billiard table. (55 #7031)
- Duggan, R. C.** See **Arthurs, A. M.**, (56 #17099) and **Arthurs, A. M.**, 56 #3734
- Edelen, Dominic G. B.** Non-local variational mechanics. IX. Lagrangians with multiple interactions. (56 #9579)
- Theories with carrier fields: multiple-interaction nonlocal formulations. (Polish and Russian summaries) 56 #13107
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- Herrera, Ismael** General variational principles applicable to the hybrid element method. 56 #16510
- Karlovitz, L. A.** See **Duffin, R. J.**, (55 #7031)
- Lawruk, B.** (with Tulczyjew, W. M.) Criteria for partial differential equations to be Euler-Lagrange equations. (56 #13277)
- Magri, Franco** Variational formulation for every linear equation. (French, German, Italian and Russian summaries) 56 #1189
- Mang, Herbert A.** (with Gallagher, Richard H.) A critical assessment of the simplified hybrid displacement method. 56 #9444
- Meffroy, Jean** Sur une extension de la théorie de la variation seconde de l'action hamiltonienne. (English summary) (55 #13482)
- Oden, J. T.** (with Reddy, J. N.) On dual-complementary variational principles in mathematical physics. (French, German, Italian and Russian summaries) 56 #9445
- Reddy, J. N.** See **Oden, J. T.**, 56 #9445
- Tulczyjew, W. M.** See **Lawruk, B.**, (56 #13277)
- Walsh, G. R.** See **Arthurs, A. M.**, 56 #1188
- Zienkiewicz, O. C.** Constrained variational principles and penalty function methods in finite element analysis. (55 #9573)



## 50–XX GEOMETRY [For algebraic geometry, see 14–XX.]

### 50–01 Elementary exposition (collegiate level)

- (Aleksandrov, P. S.) See Hilbert, David; et al., 55 #3935  
 Baur, Arnold See Fladt, Kuno, (55 #3978)  
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 Cohn-Vossen, Stefan See Hilbert, David, 55 #3935  
 Fladt, Kuno (with Baur, Arnold) ★Analytische Geometrie spezieller Flächen und Raumkurven. (55 #3978)  
 Goloviná, L. I. (with Jaglom, I. M.) ★Inducción en la geometría. (Spanish) [Induction in geometry] 56 #9446  
 Hilbert, David (with Cohn-Vossen, Stefan) ★Anschauliche Geometrie. 55 #3935  
 Jaglom, I. M. See Goloviná, L. I., 56 #9446  
 Rosen, Joe ★Symmetry discovered. (55 #12794)  
 Ślusarczyk, Bronisław ★Geometria rzutowa i wykreślna w zakresie krzywych i powierzchni stopnia drugiego. (Polish) [Projective and descriptive geometry within the limits of second degree curves and surfaces] 55 #3936  
 (Vega, Carlos) See Goloviná, L. I.; et al., 56 #9446  
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 Proceedings:  
 All-Union Seminar of Department Heads and Teaching Staff of the Geometry Departments of the Pedagogical Institutes of the USSR ★Труды Всесоюзного семинара заведующих кафедрами и преподавателей геометрических институтов СССР (Тбилиси, 19–22 декабря 1972 года). (Russian) [Proceedings of the All-Union Seminar of Department Heads and Teaching Staff of the Geometry Departments of the Pedagogical Institutes of the USSR (Tbilisi, December 19–22, 1972)] 55 #6290

### 50–02 Advanced exposition (research surveys, etc.)

### 50–03 Historical

- (Desargues, Girard) See Vita, Vincenzo, (55 #12421)  
 Fritsch, Rudolf ★Zum Feuerbachschen Kreis. (56 #5160)  
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 Naitō, Jun Malfatti's problem in sangaku. (Japanese) (55 #29)  
 Pedoe, Daniel Notes on the history of geometrical ideas. II. The principle of duality. (55 #7681)  
 Vita, Vincenzo Il teorema sul quadrangolo completo nel Brouillon project di Desargues. (55 #12421)

### 50–04 Explicit machine computation and programs (not the theory of computation or programming)

### 50–06 Collections of papers; proceedings of conferences

## 50Axx Foundations

### 50A05 Euclidean

- Albis González, Victor Samuel (with Moreno Armella, Luis) A hypothesis equivalent to Euclid's parallel postulate. (Spanish) 56 #6537  
 Böhm, Johannes (with Hertel, E.; Mögling, W.; Börner, W.; Krötenheerdt, Otto; Stammer, L.) ★Geometrie. I. 55 #11139  
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 Dennert, Manfred Zum Schurschen Vorschlag für die Behandlung von Geraden und Ebenen. (English, Russian and French summaries) 56 #13108  
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 Stammer, L. See Böhm, Johannes; et al., 55 #11139  
 (Wussing, Hans) See Böhm, Johannes; et al., 55 #11139

### 50A10 Noneuclidean

- Abbasov, N. T. Groups of motions of elliptic spaces over algebras of antialternions. (Russian. Azerbaijani summary) 56 #6538  
 Martin, George E. ★The foundations of geometry and the non-Euclidean plane. 55 #1209  
 Rabinovič, V. L. Proof of the consistency of Lobačevskii geometry on the basis of the system of axioms of a school geometry course. (Russian) (55 #7759)

### 50A15 Transformation groups

- Bachmann, Friedrich Hjelslev groups. (Italian summary) 56 #1190  
 (with Knüppel, Frieder) Verallgemeinertes Lotschnittaxiom. 56 #13109  
 von Benda, Heike (with Knüppel, Frieder) Hjelslev-Gruppen über lokalen Ringen. 55 #3937  
 Chiellini, P. Il corpo commutativo delle rotomotetie piane concentriche. 55 #6291  
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 Moszner, Zenon L'orientation dans la géométrie de Klein. 55 #3938  
 Stach, K. Einige Bemerkungen zur Verzweigung des Punktes durch einen Komplex von Transformationen. 56 #6539

- 50A20 Algebraic characterizations [See also 06A75, 12K05, 16A76, 16A78, 16A80, 17D05, 17E05, 20N10.]

- Batbedat, André Préalgèbres contenant un idempotent associatif. (Italian summary) (56 #5665)  
 Deux caractérisations des espaces affines. 55 #3939  
 Tits, Jacques Classification of buildings of spherical type and Moufang polygons: a survey. (Italian summary) (56 #3140)  
 Wähling, Heinz Beispiel eines projektiven Fastkörpers mit nicht-projektiven Teilfastkörpern. (56 #2980)  
 Projektive Inzidenzgruppoiden und Fastalgebren. (English summary) 56 #6540

### 50A25 Models [See also 02H15.]

### 50A30 Length, area, volume

- Busemann, Herbert Problem IV: Desarguesian spaces. 55 #3940  
 Hertel, E. Zum Archimedischem Axiom. 55 #3941

### 50A99 None of the above, but in this section

## 50Bxx Euclidean geometry (including equiform geometry)

### 50B05 Constructions

- Amir-Moëz, Ali R. (with Hamilton, J. D.) Hippocrates (Ἱπποκράτης). (56 #2722)  
 Groenman, Jakob Tjakko Die Wallace-Geraden. 55 #6292  
 Hamilton, J. D. See Amir-Moëz, Ali R., (56 #2722)  
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 Kmet, Andrej Graphic solution of cubic equations with quadratic parabola. (Slovenian. English summary) 56 #6541  
 Lee, L. P. ★Conformal projections based on elliptic functions. (55 #5176)

### 50B10 Metric formulae

- Blume, Klaus-Dieter Zur Konstruktion von Viereckengetrieben. 55 #3942  
 Bottema, O. (with Veldkamp, G. R.) On the lines in space with equal distances to  $n$  given points. 56 #13110  
 Brewer, Dennis W. A cut-and-paste proof of the Pythagorean theorem. 56 #1191  
 Bruni, Marcello Generalizzazione dimensionale di un teorema di geometria elementare. 55 #8950  
 De Temple, Duane W. (with Engquist, Michael L.) Polygonal cycloids. 55 #13331  
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 Engquist, Michael L. See De Temple, Duane W., 55 #13331  
 Forsyth, J. S. See Melzak, Z. A., (56 #7188)  
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 Reuschel, Arnulf Berührungseigenschaften des Feuerbachkreises. Zusammenhang zwischen der Caseyschen Verallgemeinerung des Satzes von Ptolemäus und Sätzen über vier Berührungskreise eines Kreises. 55 #3943  
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 Schröder, Eberhard Untersuchungen zu einem hyperoskulierenden Büschel von Kegelschnitten. II. 55 #6295  
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 Sidoruk, R. M. Elements of the geometric theory of distinguishability. (Russian) 55 #6296  
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 Veldkamp, G. R. See Bottema, O., 56 #13110

### 50B15 Inequalities

### 50B20 Geometry of circles

- Fritsch, Rudolf ★Zum Feuerbachschen Kreis. (56 #5160)  
 Pedoe, Daniel An algebra of circles. 55 #1210

### 50B25 Euclidean and equiform geometry over fields other than the reals

- Rozenfel'd, B. A. (with Vyplavina, R. P.; Zernova, T. A.) Elliptic lines and Euclidean planes over tensor products of fields. (Russian) 55 #1211  
 Vyplavina, R. P. See Rozenfel'd, B. A.; et al., 55 #1211  
 Zernova, T. A. See Rozenfel'd, B. A.; et al., 55 #1211

### 50B30 Regular figures, division of space [See also 20H15.]

- Becker, William Formulating polyhedral nets. (55 #11147)  
 Bitner, James Tiling  $5n \times 12$  rectangles with Y-pentominoes. (55 #149)  
 Collatz, Lothar Einige Beziehungen zwischen Graphen, Geometrie und Kombinatorik. (English summary) (55 #187)



- Coxeter, H. S. M.** (with Shephard, G. C.) Regular 3-complexes with toroidal cells. 55 #11140
- Golubev, S. Ja.** A certain property of lattices that relates polyhedra of the  $L$ - and  $V$ -subdivisions of the lattices. (Russian) (55 #2770)
- Grünbaum, Branko** (with Shephard, G. C.) The eighty-one types of isohedral tilings in the plane. 56 #6542
- Hollander, David H.** An unexpected two-dimensional space-group containing seven of the twelve basic solutions to the eight queens problem. (55 #3107)
- Killingbergtrø, Hans Georg** Remark on Brun's spherical tessellations. (Norwegian. English summary) 56 #1192
- Linhart, Johann** Ein reguläres hyperbolisches Maximalmosaik. (56 #1206)
- Loeb, Arthur L.** ★Space structures. 56 #9447
- Pelling, M. J.** Regular simplices with rational vertices. 56 #3736
- Pugh, Anthony** ★Polyhedra: a visual approach. 56 #9448
- Reingold, Edward M.** See Yao, Andrew Chi Chih; et al., (56 #5416)
- Sands, Bill** See Yao, Andrew Chi Chih; et al., (56 #5416)
- Shephard, G. C.** See Coxeter, H. S. M., 55 #11140 and Grünbaum, Branko, 56 #6542
- Smith, Cyril Stanley** See Loeb, Arthur L., 56 #9447
- Yao, Andrew Chi Chih** (with Reingold, Edward M.; Sands, Bill) Tiling with incomparable rectangles. (56 #5416)

## 50B35 Other groups generated by reflections

- Eaton, Morris L.** (with Perlman, Michael D.) Reflection groups, generalized Schur functions, and the geometry of majorization. (56 #3211)
- Mielniczuk, Wiesław** (with Zabłski, Jerzy) Isometries as compositions of symmetries with axes belonging to the sum of a pencil and a direction. (Polish) 56 #13111
- Perlman, Michael D.** See Eaton, Morris L., (56 #3211)
- Zabłski, Jerzy** See Mielniczuk, Wiesław, 56 #13111

## 50B99 None of the above, but in this section

## 50Cxx Other metric geometries

### 50C05 Elliptic and hyperbolic, general

- Böhm, Johannes** Über die Struktur orthogonal-entarteter elliptischer Orthoscheme. 55 #1212
- Familiari-Calapso, Maria Teresa** Intorno ad alcune formole sui triangoli rettangoli in geometria iperbolica. 55 #11141
- Guc, A. K.** Mappings of families of sets in a Lobačevskii space. (Russian) 55 #6297
- Heimbeck, Günter** Zur gruppentheoretischen Kennzeichnung elliptischer Bewegungsgruppen. (56 #5743)

### 50C10 Elliptic and hyperbolic inequalities

### 50C15 Groups generated by elliptic and hyperbolic reflections [See also 20H10.]

- Kühlbrandt, Harold** Halbdrehungsebenen und Fortsetzung von Ordnungsfunktionen auf punktiert-affine Inzidenzgruppen. 55 #6298

### 50C20 Hyperbolic convexity

- Vermes, Imre** The covering of the hyperbolic plane by asymptotic polygons. (Hungarian. German summary) 56 #9449

### 50C25 Other metric geometries

- Dicuonzo, Vincenzo** Sulla rappresentazione di uno spazio metrico e dei suoi due tipi di piani su un piano di inversione ovoidale, costruito sopra un campo di caratteristica  $> 2$ . (English summary) 55 #3944
- Pomilio, Isabella Anastasia** La geometria delle catene della retta proiettiva complessa e lo spazio di De Sitter. (English summary) 55 #3945

## 50Dxx Geometries of other transformation groups

### 50D05 Affine geometry, general

- Batbedat, André** Deux caractérisations des espaces affines. (55 #3939)
- Espaces de Permutti généralisés. (Italian and English summaries) 55 #1214a
- Le problème de Pizzarello sur les sous-espaces géométriques d'un espace de Permutti. (Italian and English summaries) 55 #1214b
- Biliotti, Mauro**  $S$ -spazi dotati di dilatazioni. 55 #3946
- Geometrie affini su un  $A$ -modulo ed  $S$ -spazi. (English summary) 55 #3947
- Burn, R. P.** ★Deductive transformation geometry. 55 #3948
- Hauptmann, Wolfgang** Geometrische Strukturen und transitive Permutationsgruppen. (56 #11829)
- Kallaher, Michael J.** Translation planes in which the stabilizer of every line is doubly transitive. 55 #3949
- A note on affine planes with transitive collineation groups. 56 #6543
- Mamistvalov, A. G.** Construction of affine invariants for point images that are given in an  $n$ -dimensional space, and their application. (Russian. Georgian and English summaries) (55 #4810)
- Nepomnjaščaja, T. Ja.** Multidimensional affine analogues of Pascal's theorem. Description of projective three-dimensional and four-dimensional Pascal configurations by the methods of model theory. (Russian) 56 #16512
- Pasini, Antonio** Affine coordinatization of incidence spaces by universal algebras. 55 #3950

- Phadke, B. B.** The theorem of Desargues in planes with analogues to Euclidean angular bisectors. (56 #3752)

**Wolff, Gerhard** "Kreisel". 55 #3951

### 50D10 Affine geometry, subgroups (centroaffine, equiaffine)

### 50D15 Descriptive geometry

- Andersen, Lone** (with Kliem, Wolfhard) Pohlke's theorem proved by means of cylindrical surfaces. (Danish. English summary) 55 #3952
- Bieberbach, Ludwig** Gaussgerade, Hönigpunkt, Steinergerade, Kegelschnitte. 55 #1215
- Cardoso, Jayme Machado** ★Sistema de projeção parabólica. (Portuguese) [System of parabolic projection] 56 #3737
- Günther, R. Helmut** Einige Eigenschaften der Doppelkurve einer speziellen algebraischen Fläche 6. Ordnung. 55 #1216
- Hedman, Bruce**  $n$ -bathycenters. (55 #11144)
- Kliem, Wolfhard** See Andersen, Lone, 55 #3952
- Krames, Josef** Über kubische Zykliken. (55 #5644)
- Seybold, H.** Beitrag zur Konstruktiven Computer-Geometrie. (English summary) 55 #8951
- Wunderlich, Walter** Fokalkurvenpaare in orthogonalen Ebenen und bewegliche Stabwerke. 55 #13334

### 50D20 Projective geometry over the reals

- Capodaglio, Rita** Sulle direzioni caratteristiche della trasformazione prodotto di due trasformazioni puntuali. (French summary) (56 #1211)
- Dediu, Mihai** See Dediu, Sofia, 55 #13335
- Dediu, Sofia** (with Dediu, Mihai) Sopra gli spazi proiettivi. (English summary) 55 #13335
- Dotson, W. G., Jr.** Symmetry of cubics. 55 #8952
- Glomb, Janina** A correspondence in projective space that is determined by cutting three polar planes of three quadrics. (Polish. Russian and English summaries) 56 #1193
- Panella Martinelli, Luigia** Una generalizzazione dell'invariante di Mehmke-Segre. (English summary) (56 #5541)

### 50D25 Projective geometry over other infinite fields

- Doignon, J.-P.** (with Valette, G.) Radon partitions and a new notion of independence in affine and projective spaces. 56 #3738
- Mandan, Sahib Ram** Geometry of a tetrahedron inscribed in a twisted cubic. (55 #5651)
- Tihomirov, A. S.** Modelling of a four-dimensional projective space on the plane by means of five associated lines. (Russian) 56 #6544
- Valette, G.** See Doignon, J.-P., 56 #3738

### 50D30 Projective geometry over finite fields

- Bernasconi, Carlo** Sistemi di assiomi che caratterizzano i disegni proiettivi. (English summary) 55 #3953
- Bose, R. C.** On a representation of the Baer subplanes of the Desarguesian plane  $PG(2, q^2)$  in a projective five dimensional space  $PG(5, q)$ . (Italian summary) 56 #3739
- Buekenhout, Francis** Characterizations of semi quadrics. A survey. (Italian summary) 56 #3740
- Carfagna D'Andrea, Antonella** Su una classe di piani metrici gruppali finiti di ordine dispari a debole struttura di incidenza. (English summary) (55 #7810)
- Di Febo Marinelli, Rosa** Il piano di Minkowski sul campo fondamentale di caratteristica 3 e il gruppo dei suoi movimenti. (English summary) 55 #1217
- Hering, Christoph** (with Walker, Michael) Perspectives in irreducible collineation groups of projective planes. I. (56 #15466)
- Korchmáros, Gabriele** Osservazioni sui risultati di B. Segre relativi ai  $k$ -archi contenenti  $k-1$  punti di un ovale. (55 #2613)
- Poligoni affin-regolari dei piani di Galois d'ordine dispari. (English summary) (55 #2614)
- Su una classificazione delle ovali dotate di automorfismi. (English summary) (56 #15467)
- Lozanov, Č.** See Martinov, N., 55 #1218
- Martinov, N.** (with Lozanov, Č.) Equivalent and isomorphic complete 6-arcs in Desarguesian projective planes. 55 #1218
- Pabst, Günther** See Sherk, F. A., 55 #3954
- Pellegrino, Giuseppe** Schemi di associazione negli spazi lineari finiti. (English summary) 55 #8953
- Segre, Beniamino** Incidence structures and Galois geometries, with special regard to regular involutive correspondences, arcs, caps, segments and conics. (Italian summary) 55 #13336
- Sherk, F. A.** (with Pabst, Günther) Indicator sets, reguli, and a new class of spreads. 55 #3954
- Walker, Michael** See Hering, Christoph, (56 #15466)
- Zeitler, Herbert** Über Ovale in endlichen Ebenen. 55 #6299

### 50D35 Projective geometry over combinatorial or nonfield structures

- Bachmann, Otto** Zur spiegelsymmetrischen Begründung von Geometrien. 55 #8954
- Betten, Dieter** 4-dimensionale Translationsebenen mit kommutativer Standgruppe. 55 #8955
- Biallas, Dieter** Zur topologie in projektiven Ebenen. 55 #3955
- Brauner, Heinrich** ★Geometrie projektiver Räume. I. 55 #3956a
- ★Geometrie projektiver Räume. II. 55 #3956b



- Bruen, A. A.** Some new replaceable translation nets. (55 #5465)
- Buckenhout, Francis** Existence of unitals in finite translation planes of order  $q^2$  with a kernel of order  $q$ . 56 #6545
- Bureš, Jarolím** (with Klouda, Josef) One generalization of quasifield. (Russian summary) 55 #3957
- Caggegi, Andrea** Una classe di quasicorpi di dimensione infinita sul loro nucleo. (English summary) 55 #11142
- Čahtauri, I. A.** Certain non-Euclidean spaces over a quasimatrix algebra. (Russian. Georgian summary) 55 #6300
- Drake, David A.** (with Hale, Mark P., Jr.) Group constructible  $(t, k)$ -nets and Hjelmslev planes. (56 #15465)
- Dugas, Manfred** Moufang-Hjelmslev-Ebenen. (55 #7812)
- Emaldi, Maurizio** Proiettività in geometrie proiettive. 55 #3958
- Erbach, D. W.** The non-existence of a certain finite projective plane. 56 #6546
- Friedlein, H. R.** Einige Eigenschaften von beliebigen Translationsebenen mit Scherungen. (English summary) 56 #3741
- Fuglister, Frederick J.** On finite Moore geometries. (56 #158)
- Geronimo, Stefano** Le similitudini fra tre piani proiettivi sovrapposti. 55 #8956
- Groze, Victoria** Configuration theorems in certain incidence structures. (Romanian summary) (55 #7813)
- Hale, Mark P., Jr.** See **Drake, David A.**, (56 #15465)
- Hall, J. I.** Bounds for equidistant codes and partial projective planes. 56 #13112
- Herzer, Armin** Neue Konstruktion einer Erweiterung von projektiven Geometrien. 56 #9450
- Projektiv darstellbare stark planare Geometrien vom Rang 4. (55 #10295)
- Kantor, William M.** On the structure of collineation groups of finite projective planes. 55 #6301
- Klouda, Josef** Ternary rings associated to translation plane. 55 #11143
- See also **Bureš, Jarolím**, 55 #3957
- Kock, Anders** Universal projective geometry via topos theory. 55 #3959
- Krier, Nicholas** (with Yaqub, Jill C. D. S.) The coexistence of elations and homologies. 55 #6302
- Löwen, Rainer** Vierdimensionale stabile Ebenen. (55 #1213)
- Lunardon, Guglielmo** Proposizioni configurazionali in una classe di fibrazioni. (English summary) 55 #3960
- Mathiak, Karl** Projektive Hjelmslevsche Räume im nicht invarianten Fall. 56 #1194
- Milici, Salvatore** Caratterizzazioni geometriche di alcune particolarità dei sistemi ternari. (55 #3134)
- Petrich, Mario** ★Categories of algebraic systems. (55 #8223)
- Pickert, Günter** ★Einführung in die endliche Geometrie. (56 #8400)
- Praeger, Cheryl E.** (with Rahilly, Alan) On partially transitive projective planes of certain Hughes types. 56 #3742
- Quattrocchi, Pasquale** Sugli insiemi di sostituzioni strettamente 3-transitivi finiti. 56 #9451
- Rahilly, Alan** See **Praeger, Cheryl E.**, 56 #3742
- Sørensen, Kay** Inzidenzgruppen der Ordnung 3. 56 #1195
- Törner, Günter** Über ein Problem von Klingenberg. (56 #8609)
- Vincenti, Rita** Sottopiani di Baer di un piano di Moufang  $\mathcal{P}$  e non derivabilità di  $\mathcal{P}$ . (English summary) 56 #3743
- Walker, Michael** On the structure of finite collineation groups containing symmetries of generalized quadrangles. 55 #13337
- Wilke, F. W.** Some new translation nets. 55 #3961
- Yaqub, Jill C. D. S.** See **Krier, Nicholas**, 55 #6302

## 50D40 Line geometry

## 50D45 Circle and sphere geometry: Lie, Laguerre, Möbius

- Ebert, Gary L.** Disjoint circles: a classification. 56 #1196
- Lee, L. P.** ★Conformal projections based on elliptic functions. (55 #5176)
- Molnár, Emil** Begründung der Möbiusschen Kreisebene aus dem Spiegelungsbegriff. 55 #6303
- Prohaska, Olaf** (with Walker, Michael) A note on the Hering type of inversive planes of even order. 55 #13338
- Konfigurationen einander meidender Kreise in miquelschen Möbiusebenen ungerader Ordnung. 56 #1197
- Walker, Michael** See **Prohaska, Olaf**, 55 #13338

## 50D50 Geometries of other space elements

## 50D99 None of the above, but in this section

## 52-XX CONVEX SETS AND GEOMETRIC INEQUALITIES

## 52-01 Elementary exposition (collegiate level)

- Guggenheimer, Heinrich W.** ★Applicable geometry. 56 #1198
- Pugh, Anthony** ★Polyhedra: a visual approach. (56 #9448)
- Rademacher, Hans** See **Steinitz, Ernst**, 55 #3962
- Steinitz, Ernst** (with Rademacher, Hans) ★Vorlesungen über die Theorie der Polyeder unter Einschluss der Elemente der Topologie. 55 #3962

## 52-02 Advanced exposition (research surveys, etc.)

## 52-03 Historical

## 52-04 Explicit machine computation and programs (not the theory of computation or programming)

## 52-06 Collections of papers; proceedings of conferences

## 52A05 Convex sets without dimension restrictions

- Beem, John K.** A bisector characterization of indefinite inner products. (55 #13222)
- Borwein, J. M.** (with O'Brien, R. J.) Tangent cones and convexity. (56 #12835)
- Briggen, Heinz** (with Rätz, Jürg) Die Einheitskugel normierter Vektorräume als Durchschnitt von Stützhalbräumen. (55 #3748)
- Cornette, William M.** A generalization of the unit interval. 56 #1199
- Edelstein, Michael** (with Keener, L.; O'Brien, R. J.) On points at which a set is cone-shaped. (56 #12842)
- Fourneau, René** Some results on the geometry of Choquet simplices. (56 #9227)
- Grygarová, Libuše** Lokale Berührungskegel einer Menge im Euklidischen Raum  $E_n$ . (Czech and loose Russian summaries) 55 #1219
- Gudder, Stanley P.** Convexity and mixtures. 55 #6304
- Gulimov, A. V.** (with Sibirjakov, G. V.) Retracts in topological linear spaces. (Russian) (55 #4182)
- Höllein, H.** Polytope in lokalkonvexen Räumen. (56 #6342)
- Jamison, Robert E.** Contractions of convex sets. 55 #1220
- Jongmans, F.** Réflexions sur l'art de sauver la face. (English summary) 56 #1200
- Keener, L.** See **Edelstein, Michael**; et al., (56 #12842)
- Klee, Victor** A linearly compact convex set dense in every vector topology. (55 #1020)
- Larman, D. G.** On the one-skeleton of a compact convex set in a Banach space. 55 #3963
- O'Brien, R. J.** See **Borwein, J. M.**, (56 #12835) and **Edelstein, Michael**; et al., (56 #12842)
- Papadopoulos, Susanne** On the geometry of stable compact convex sets. (56 #9228)
- Rätz, Jürg** See **Briggen, Heinz**, (55 #3748)
- Roberts, A. Wayne** (with Varberg, Dale E.) ★Convex functions. 56 #1201
- Rohn, Jifi** Separatedness of systems of open convex sets. (Czech. Russian, English and German summaries) (56 #9229)
- Rubinstein, G. Š.** (with Vladimirov, Ju. N.) Increasing functions of bounded convex variation. (Russian) (56 #15855)
- Sibirjakov, G. V.** See **Gulimov, A. V.**, (55 #4182)
- Szafron, D. A.** (with Weston, J. H.) An internal solution to the problem of linearization of a convexity space. (56 #9230)
- Varberg, Dale E.** See **Roberts, A. Wayne**, 56 #1201
- Vlach, Milan** A note on separation by linear mappings. 55 #6305
- Vladimirov, Ju. N.** See **Rubinstein, G. Š.**, (56 #15855)
- von Weizsäcker, Heinrich** A note on infinite dimensional convex sets. (55 #1039)
- Weston, J. H.** See **Szafron, D. A.**, (56 #9230)

## 52A10 Convex sets in 2 dimensions

- Converse, George** Sets with a mode. 55 #13339
- Falconer, K. J.** Applications of outwardly simple line families to plane convex sets. 56 #3744
- Gil, M. I.** See **Stojan, Ju. G.**, 55 #8957
- Hedman, Bruce**  $n$ -bathycenters. 55 #11144
- Nasritdinov, G.** A mapping of a convex polygon. (Russian) 56 #16513
- Scott, P. R.** On convex lattice polygons. 55 #3964
- Stojan, Ju. G.** (with Gil, M. I.) ★Методы и алгоритмы размещения плоских геометрических объектов. (Russian) [Methods and algorithms for the placing of plane geometric objects] 55 #8957

## 52A15 Convex sets in 3 dimensions

52A20 Convex sets in  $n$  dimensions

- Bazaraa, Mokhtar S.** (with Shetty, C. M.) ★Foundations of optimization. (55 #2141)
- Bokowski, Jürgen** (with Haddad, A. H.; Wills, J. M.) Eine Erweiterung der Croftonschen Formeln für konvexe Körper. 55 #3965
- Breen, Marilyn** Sets which can be extended to  $m$ -convex sets. 55 #3966
- Bromek, T.** (with Kaniewski, J.) Linear images and sums of closed cones in Euclidean spaces. (Russian summary) (55 #2121)
- Brøndsted, Arne** Intersections of translates of convex sets. 56 #9452
- Brylawski, T. H.** A combinatorial perspective on the Radon convexity theorem. 55 #13340
- Burton, G. R.** On the sum of a zonotope and an ellipsoid. 55 #11145
- Chakerian, G. D.** (with Groemer, H.) On convex bodies containing a given number of lattice points. (56 #5474)
- Doignon, J.-P.** (with Valette, G.) Radon partitions and a new notion of independence in affine and projective spaces. (56 #3738)
- Falconer, K. J.** A result on the Steiner symmetrization of a compact set. 55 #3967
- Ficheux, Françoise** See **Rubinstein, G. Š.**, (55 #13323)
- Geivaerts, Marcel** Vector spaces consisting of classes of convex bodies. 55 #11146
- Groemer, H.** See **Chakerian, G. D.**, (56 #5474)
- Gruber, Peter M.** Über ein Problem von Eggleston aus der Konvexität. 56 #13113
- Die meisten konvexen Körper sind glatt, aber nicht zu glatt. 56 #1202
- Haddad, A. H.** See **Bokowski, Jürgen**; et al., 55 #3965
- (Hornich, Hans)** See **Gruber, Peter M.**, 56 #13113
- Ivanov, B. A.** The exceptional directions for a convex body. (Russian) 55 #1221
- Kaniewski, J.** See **Bromek, T.**, (55 #2121)
- Khassa, Dharam Singh** Relation between maximal chords and symmetry for convex sets. 56 #3745
- Kuz'minyh, A. V.** Mappings that preserve the convexity of cones. (Russian) 55 #13341
- Lewin, Mordechai** On the extreme points of the polytope of symmetric matrices with given row sums. (56 #2846)
- Loginov, E. A.** Topological mapping of a convex body onto a ball. (Russian) (56 #16594)



- Reiter, Harold** Convex sets, Cantor sets and a midpoint property. **56** #1203
- Rubinstein, G. Š.** (with Ficheux, Françoise) Quasiconvex preorders. (Russian) **(55** #13323)
- Schneider, Rolf** Eine kinematische Integralformel für konvexe Körper. **(55** #1181)
- Schöpf, Peter** Schüttelung konvexer Mengen. **55** #3968
- Shetty, C. M.** See **Bazaraa, Mokhtar S.**, **(55** #2141)
- Spiegel, Wolfgang** Zur Minkowski-Additivität bestimmter Eikörperabbildungen. **55** #3969
- Stachó, L. L.** On the volume function of parallel sets. **(56** #588)
- Valette, G.** See **Doignon, J.-P.**, **(56** #3738)
- Waksman, Z.** On the shadows and the sections of convex sets. **55** #3970
- Wills, J. M.** See **Bokowski, Jürgen**; et al., **(55** #3965)
- Zimmermann, Karel** A general separation theorem in extremal algebras. (Czech summary) **(56** #11869)

## 52A25 Convex polyhedra

- Adler, Ilan** (with Dantzig, George B.; Murty, Katta G.) Existence of  $A$ -avoiding paths in abstract polytopes. **55** #6306
- Bair, Jacques** (with Fourneau, René) Caractérisation de polyèdres convexes et systèmes d'inéquations linéaires. (English summary) **55** #3971
- Une étude des sommants d'un polyèdre convexe. (English summary) **55** #13342
- Becker, William** Formulating polyhedral nets. **55** #11147
- Betke, U.** (with Schulz, Ch.; Wills, J. M.) Zur Zerlegbarkeit von Skeletten. **55** #13343
- Beynon, W. M.** On rational subdivisions of polyhedra with rational vertices. **55** #11148
- Blind, Gerd** Zerlegung eines konvexen Polygons in konvexe Polygone. **55** #8958
- Brualdi, Richard A.** (with Gibson, Peter M.) Convex polyhedra of doubly stochastic matrices. IV. **(56** #5606)
- Buchman, Edwin** (with Valentine, F. A.) External visibility. **55** #11149
- Burns, Fennell** (with Fiedler, Miroslav; Haynsworth, Emilie) Polyhedral cones and positive operators. **(56** #8598)
- Coxeter, H. S. M.** Virus macromolecules and geodesic domes. **56** #6547
- (with Shephard, G. C.) Regular 3-complexes with toroidal cells. **(55** #11140)
- Dantzig, George B.** See **Adler, Ilan**; et al., **55** #6306
- Eaton, Morris L.** (with Perlman, Michael D.) Reflection groups, generalized Schur functions, and the geometry of majorization. **(56** #3211)
- Fiedler, Miroslav** See **Burns, Fennell**; et al., **(56** #8598)
- Fourneau, René** See **Bair, Jacques**, **55** #3971
- Gibson, Peter M.** Facets of faces of transportation polytopes. **55** #3972
- See also **Brualdi, Richard A.**, **(56** #5606)
- Glover, Fred** Faces of the Gomory polyhedron. **(55** #9963)
- Gomory, R. E.** Properties of a class of integer polyhedra. **(55** #9964)
- Gruber, Peter M.** Über den Durchschnitt einer abnehmenden Folge von Parallelepipeden. **55** #11150
- Haynsworth, Emilie** See **Burns, Fennell**; et al., **(56** #8598)
- Lillington, J. N.** On polytopes with small faces. **55** #3973
- Linhart, Johann** Über die Kantenlängensumme von Dreieckspolyedern. **55** #8959
- Mattheiss, T. H.** An algorithm for determining irrelevant constraints and all vertices in systems of linear inequalities. **(55** #10020)
- McMullen, P.** Metrical and combinatorial properties of convex polytopes. **55** #3974
- Valuations and Euler-type relations on certain classes of convex polytopes. **56** #6548
- Murty, Katta G.** See **Adler, Ilan**; et al., **55** #6306
- Patterson, E. M.** Some aspects of Euler's theorem. **(56** #5116)
- Perlman, Michael D.** See **Eaton, Morris L.**, **(56** #3211)
- Riives, K.** Affine classification and characterizations of convex polytopes in the Euclidean space  $R_n$ . IV. (Russian. Estonian and English summaries) **55** #11151
- Schulz, Ch.** See **Betke, U.**; et al., **55** #13343
- Shephard, G. C.** See **Coxeter, H. S. M.**, **(55** #11140)
- Stanley, Richard P.** The upper bound conjecture and Cohen-Macaulay rings. **(56** #16640)
- Valentine, F. A.** See **Buchman, Edwin**, **55** #11149
- Wills, J. M.** See **Betke, U.**; et al., **55** #13343
- Zaslavsky, Thomas** A combinatorial analysis of topological dissections. **(56** #5310)
- Zil'berberg, A. A.** The existence of closed convex pyramidal polyhedra with arbitrarily prescribed curvatures of the vertices. (Russian) **(56** #9465)

## 52A30 Star-shaped sets

- Boltjanskii, V. G.** (with Soltan, P. S.) Star-shaped sets. (Russian) **55** #3975
- Soltan, P. S.** See **Boltjanskii, V. G.**, **55** #3975
- Stanek, Jean Chan** A characterization of starshaped sets. **56** #3746

## 52A35 Helly-type theorems

- Dziechcińska-Halamoda, Zyta** (with Romanowicz, Zbigniew) A proof of a generalized Helly's theorem. **56** #16514
- Katchalski, Meir** The dimension of intersections of convex sets. II. **56** #6549
- Romanowicz, Zbigniew** See **Dziechcińska-Halamoda, Zyta**, **56** #16514
- Silverman, Ruth** A characterization of convex surfaces of Helly-type. **55** #6307

## 52A40 Inequalities and extremum problems

- Adler, Ilan** (with Saigal, Romesh) Long monotone paths in abstract polytopes. **(56** #4810)
- Alexander, Ralph** On the sum of distances between  $n$  points on a sphere. II. **56** #3747
- Bod, Péter** On closed convex sets that have a minimal element. (Hungarian. English and Russian summaries) **55** #8960
- Borwein, J. M.** Multivalued convexity and optimization: a unified approach to inequality and equality constraints. **56** #9453

- Fejes Tóth, G.** An isoperimetric problem for tessellations. **56** #3748
- Fejes Tóth, László** Remarks on the dual to Tarski's plank problem. (Hungarian. English summary) **56** #1204
- Gabbay, Henry** A note on polyhedral sets having a least element. **55** #6308
- Hammer, Joseph** ★Unsolved problems concerning lattice points. **56** #16515
- Hartung, Joachim** A sequential regularization method for finding saddle points. **(55** #10617)
- Karlin, Samuel** (with Ziegler, Zvi) Some applications to inequalities of the method of generalized convexity. **55** #11152
- Katona, Gyula** The Hamming-sphere has minimum boundary. **(56** #11533)
- Klamkin, Murray S.** (with Schlesinger, Ernest C.) Diamond inequalities. **55** #8961
- Knop, Osvald** See **Melnik, Theodor William**; et al., **(56** #2848)
- Lillington, J. N.** Geometric inequalities involving the stretch of a set. **55** #11153
- Lin, Tung Po** Maximum area under constraint. **55** #3976
- Lutwak, Erwin** On cross-sectional measures of polar reciprocal convex bodies. **55** #1222
- Marzollo, A.** (with Pascoletti, Adriano) Computational procedures and properties of the geometrical difference of sets. en55 #6309
- McGregor, M. T.** On inequalities related to triangles. **56** #3749
- Melnik, Theodor William** (with Knop, Osvald; Smith, William Robert) Extremal arrangements of points and unit charges on a sphere: equilibrium configurations revisited. (French summary) **(56** #2848)
- Osserman, Robert** Some remarks on the isoperimetric inequality and a problem of Gehring. **56** #3750
- Oxtoby, John C.** Diameters of arcs and the gerrymandering problem. **55** #6310
- Palásti, Ilona** The ratio of black and white polygons of a map generated by general straight lines. **55** #11154
- Pascoletti, Adriano** See **Marzollo, A.**, **55** #6309
- Raiko, S. A.** A certain extremal problem of a finite-dimensional normed space. (Russian) **56** #13114
- Robinson, Stephen M.** Regularity and stability for convex multivalued functions. **(55** #3188)
- Saigal, Romesh** See **Adler, Ilan**, **(56** #4810)
- Schlesinger, Ernest C.** See **Klamkin, Murray S.**, **55** #8961
- Smith, William Robert** See **Melnik, Theodor William**; et al., **(56** #2848)
- Tomonaga, Yasurō** ★Geometry of length and area. I. **55** #3977
- Wang, Da Lun** (with Wang, Ping) Extremal configurations on a discrete torus and a generalization of the generalized Macaulay theorem. **55** #11155
- Wang, Ping** See **Wang, Da Lun**, **55** #11155
- Wegmann, Rudolf** Extremalfiguren für eine Klasse von isoperimetrischen Problemen. **55** #1223
- Wolfe, Philip** Finding the nearest point in a polytope. **(56** #10962)
- Ziegler, Zvi** See **Karlin, Samuel**, **55** #11152

## 52A45 Packing and covering [See also 05B40, 10E30, 50B30.]

- Benedikti, István** On the solidity of set arrangements. (Hungarian. English summary) **56** #3751
- Blind, Gerd**  $r$ -zugängliche Unterdeckungen der Ebene durch kongruente Kreise. I. **56** #1205a
- $r$ -zugängliche Unterdeckungen der Ebene durch kongruente Kreise. II. **56** #1205b
- Bokowski, Jürgen** ★Obere Schranken zur Gitterpunktsanzahl konvexer Körper. **(56** #8517)
- Fejes Tóth, László** Some remarks on saturated sets of points. **56** #16516
- On Hadwiger numbers and Newton numbers of a convex body. **55** #13344
- Close packing and loose covering with balls. **55** #1224
- Goldberg, Michael** On the space-filling hexahedra. **56** #6550
- Heidler, K.** Die Unentscheidbarkeit des Eck-Dominoproblems. **(55** #5427)
- Horváth, Jenő** Packing of unit spheres in spherical shells. (Hungarian. German summary) **56** #6551
- Linhart, Johann** Ein reguläres hyperbolisches Maximalmosaik. **56** #1206
- Milnor, John W.** Hilbert's problem 18: on crystallographic groups, fundamental domains, and on sphere packing. **(55** #3108)
- Vermes, Imre** The covering of the hyperbolic plane by asymptotic polygons. (Hungarian. German summary) **(56** #9449)
- Zbinden, A.** Überdeckung eines Quadrates durch 6 kongruente Kreise. **56** #6552

## 52A50 Hilbert geometry and other distance geometries

- Alexander, Ralph** Two notes on metric geometry. **56** #1207
- Bair, Jacques** (with Dessard, A.) Enveloppe  $j$ -simplicialement convexe et  $j$ -coeur simplicial dans l'espace à convexité. **56** #16517
- Dessard, A.** See **Bair, Jacques**, **56** #16517
- Kántor, S.** Über die Zerlegungsgleichheit. **55** #1225
- Phadke, B. B.** The theorem of Desargues in planes with analogues to Euclidean angular bisectors. **56** #3752

## 52A55 Spherical convexity [See also 50C20.]

## 53-XX DIFFERENTIAL GEOMETRY [For differential topology, see 57Dxx. For foundational questions of differentiable manifolds, see 58Axx.]

### 53-01 Elementary exposition (collegiate level)

- Baur, Arnold** See **Fladt, Kuno**, **55** #3978
- Fladt, Kuno** (with Baur, Arnold) ★Analytische Geometrie spezieller Flächen und Raumkurven. **55** #3978



- Hinchey, Fred A. ★Vectors and tensors for engineers and scientists. 55 #1226  
 Lawden, Derek F. ★An introduction to tensor calculus and relativity. (55 #11893)  
 Millman, Richard S. (with Parker, George D.) ★Elements of differential geometry. 56 #1208  
 Parker, George D. See Millman, Richard S., 56 #1208  
 Radziszewski, Konstanty ★Wstęp do współczesnej geometrii różniczkowej. (Polish) [Introduction to modern differential geometry] 55 #3979  
 Robertson, S. A. Riemannian geometry. 55 #11156  
 Global analysis and its applications See Robertson, S. A., 55 #11156

### 53-02 Advanced exposition (research surveys, etc.)

### 53-03 Historical

- Bazylev, V. T. On the ninetieth anniversary of the birth of S. P. Finikov. (Russian. English summary) (55 #5348)  
 (Finikov, S. P.) See Bazylev, V. T., (55 #5348)  
 Biography:  
 Finikov, S. P. See Bazylev, V. T., (55 #5348)

### 53-04 Explicit machine computation and programs (not the theory of computation or programming)

### 53-06 Collections of papers; proceedings of conferences

- (Cahen, Michel) See Differential geometry and relativity, 55 #3980  
 (Flato, M.) See Differential geometry and relativity, 55 #3980  
 (Gamkrelidze, R. R.) See Problems in geometry, 56 #9454  
 (Lichnerowicz, André) See Differential geometry and relativity, 55 #3980  
 (Pompeiu, Dimitrie) See Symposium: "Gheorghe Țițeica and Dimitrie Pompeiu", Geometry and Global Analysis, (55 #2428)  
 (Țițeica, Gheorghe) See Symposium: "Gheorghe Țițeica and Dimitrie Pompeiu", Geometry and Global Analysis, (55 #2428)  
 (Vranceanu, Gheorghe) See Symposium: "Gheorghe Țițeica and Dimitrie Pompeiu", Geometry and Global Analysis, (55 #2428)  
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 Lichnerowicz, André See Differential geometry and relativity, 55 #3980  
 Differential geometry and relativity ★Differential geometry and relativity. 55 #3980  
 Geometry See Problems in geometry, 56 #9454 and Symposium: "Gheorghe Țițeica and Dimitrie Pompeiu", Geometry and Global Analysis, (55 #2428)  
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 Itogi Nauki i Tehniki See Problems in geometry, 56 #9454  
 Problems in geometry ★Проблемы геометрии, Том 7. (Russian) [Problems in geometry, Vol. 7] 56 #9454  
 Relativity See Differential geometry and relativity, 55 #3980  
 Symposium:  
 Geometry and Global Analysis See Symposium: "Gheorghe Țițeica and Dimitrie Pompeiu", Geometry and Global Analysis, (55 #2428)  
 "Gheorghe Țițeica and Dimitrie Pompeiu", Geometry and Global Analysis ★Simpozional de geometrie și analiză globală "Gheorghe Țițeica și Dimitrie Pompeiu". (Romanian) [The "Gheorghe Țițeica and Dimitrie Pompeiu" Symposium on Geometry and Global Analysis] (55 #2428)

## 53Axx Classical differential geometry

### 53A05 Curves and surfaces in euclidean space

- Braemer, Jean-Marc (with Kerbrat, Yvan) ★Géométrie des courbes et des surfaces. 55 #1227  
 Fémpl, Stanimir Eine geodätische Linie auf der Kegelfläche. 56 #6553  
 Frank, Hubert Strahlinematik im pseudoeuklidischen Raum. 56 #13115  
 Glazyrin, V. V. The Riemannian curvature of multidimensional saddle surfaces. (Russian) 56 #9455  
 Hartmann, E. Übergangsflächen bei Regelschraubflächen. 56 #13116  
 Hentschke, Siegfert Erweiterungen des Satzes von Holditch. 55 #8962  
 Ichida, Ryosuke On non-parametric surfaces in three dimensional spheres. 55 #8963  
 Kerbrat, Yvan See Braemer, Jean-Marc, 55 #1227  
 Litvin, F. L. Determination of the enveloping lines of contact of mutually enveloped surfaces. (Russian) 55 #3981  
 Miheeva, Z. A. On the question of infinitesimal affine deformations of surfaces. (Ukrainian. English and Russian summaries) 55 #8964  
 Müller, Hans Robert Kurven konstanter Breite und Schiebkurven. 55 #8965  
 Naas, Josef (with Tutschke, W.) Differentialformenkalkül mit komplexen Differentiationen  $\partial/\partial z$  und  $\partial/\partial \bar{z}$  und Anwendung in der Flächentheorie. 55 #3982  
 Ruskol, D. E. Tensors that determine a surface up to similarity transformations. (Russian) 55 #1228  
 Simokin', P. L. Certain questions on infinitesimal affine deformations of developable surfaces. (Ukrainian. French and Russian summaries) 56 #16518  
 Tölke, Jürgen Eine äquifforme Charakterisierung der euklidischen Bewegungen vermöge einander oskulierender Hüllkurvenpaare. 56 #13117  
 Tutschke, W. See Naas, Josef, 55 #3982  
 Veresova, E. E. The mean normals of a  $V_2$  in  $R_4$ . (Russian) 56 #16519  
 Vranceanu, G. G. See Vranceanu, Gheorghe, 55 #8966  
 Vranceanu, Gheorghe (with Vranceanu, G. G.) Surfaces with positive constant or null curvature in  $E_4$ . 55 #8966

### 53A10 Minimal surfaces

- Almgren, Frederick J., Jr. (with Thurston, William P.) Examples of unknotted curves which bound only surfaces of high genus within their convex hulls. 56 #1209  
 Nitsche, Johannes C. C. ★Vorlesungen über Minimalflächen. (56 #6533)  
 Rassias, Themistocles M. Sur la multiplicité du premier bord conjugué d'une hypersurface minimale de  $R^n$ ,  $n \geq 3$ . (English summary) (55 #4266)  
 Thurston, William P. See Almgren, Frederick J., Jr., 56 #1209  
 Tomi, Friedrich On the finite solvability of Plateau's problem. 56 #13118

### 53A15 Affine differential geometry

- Bompiani, Enrico Una estensione della nozione di spazio osculatore ad una varietà. (English summary) 55 #6311  
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 Meyer, P. Eine Bemerkung zu einer Integralformel von Cauchy. (55 #8998)  
 Pečnikov, I. A. The framing of submanifolds of Pfaffian manifolds. (Russian) 55 #3983  
 Vikaruk, A. Ja. Analogues of the Nevanlinna theorems for minimal surfaces. (Russian) 55 #8967

### 53A20 Projective differential geometry

- Bayer, Jaroslav Die Projektivabwicklung zweiter und dritter Ordnung von Ebenen-kongruenzen im achtdimensionalen projektiven Raum. (Loose Russian summary) 56 #1210  
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 Kaizer, V. V. Extensions, restrictions and conjugate directions of differentiable distributions in multidimensional projective spaces. (Russian) 55 #3984  
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 Krugljakov, L. Z. (with Sušnikov, B. S.) Pseudocongruences of  $d$ -planes in  $P_{2d+2}$ . (Russian) 55 #3985  
 On the differential geometry of families of subspaces in a projective space. (Russian) 55 #3986  
 Lenev, V. S. Nets with common normals in  $P_4$ . (Russian) 56 #16521  
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 Norden, A. P. The space of a norm-curve. (Russian) 55 #3988  
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### 53A25 Differential line geometry

- Barabosin, N. M. On the dual-conformal geometry of a line complex. (Russian) 56 #13121  
 On the theory of nets of surfaces of a line complex. (Russian) 56 #13122  
 Baryktasov, E. D. On the affine geometry of non-holonomic complexes. (Russian) 55 #1229  
 The connection between nonholonomic congruences and points of nonholonomicity. (Russian) 55 #3990  
 Bektenov, A. S. Certain properties of a spatial 3-dimensional net and its coordinate ternary quasigroup. (Russian) 55 #11158  
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## 53A30 Conformal differential geometry

## 53A35 Noneuclidean differential geometry

- Lübbert, Christoph** Über Regelflächen mit speziellen Schmiegequadricken im elliptischen Raum. **55** #1230  
 Die Böschungsf lächen des elliptischen Raumes. **55** #6314  
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**Stachel, Hellmuth** Quasielliptische Schiebflächen mit einparametrischer Bewegungsgruppe. **55** #3995  
**Tölke, Jürgen** Zum sphärischen Analogon der Ellipsenbewegung. **55** #6315

## 53A40 Other special differential geometries

- Baryševa, V. K.** The manifold  $E(0, 2, 3)$  in five-dimensional equiaffine space. (Russian) **en56** #13123  
**Borisov, Adrijan** Canonical frame of a line complex in three-dimensional space with an absolute of two real planes and two real points on the curve of their intersection. (Bulgarian. Russian and German summaries) **55** #11160  
**Borovec', G. M.** Complexes of projective rotation in symplectic space. (Ukrainian. English and Russian summaries) **56** #13124  
**Careva, Bistra B.** Canonical frame of a curve in three-dimensional projective space with an absolute of two real points and a real line through one of them. (Russian) **55** #8971  
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**Sarna, Ryszard** See **Kuklewski, Julian**, **55** #8974  
**Stamou, Georg** Integral- und Identitätssätze für Strahlensysteme im einfach isotropen Raum. **56** #6554  
**Vernikov, M. B.** Elements of tangency of a surface in a symplectic space. The general case. (Russian) **55** #1233

## 53A45 Vector and tensor analysis

- Annin, B. D.** Anisotropic tensor functions. (Russian) **56** #9456  
**Brehmer, Siegfried** (with Haar, H.) ★Differentialformen und Vektoranalysis. (**55** #11288)  
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**Minčić, Svetislav M.** Curvature tensors of the space of non-symmetric affine connexion, obtained from the curvature pseudotensors. **55** #11162  
**Minibaeva, F. G.** Contraction of tensors in a space over a commutative algebra. (Russian) **55** #8976  
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**Smith, G. F.** On symmetric-tensor-valued isotropic functions of two symmetric tensors. **56** #3754  
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- Ament, W. S.** ★Finite arithmetics applying to certain geometric algebras. (**55** #2968)  
**Casanova, Gaston** ★L'algebre vectorielle. **56** #1213  
**Santaló, Luis A.** ★Geometria espinorial. (Spanish) [Spinor geometry] **55** #11163

## 53A55 Differential invariants (local theory), geometric objects

- Bieszk, Leon** (with Stygar, Danuta) Density concomitants of the curvature tensor  $R_{\alpha\beta\gamma}^{\delta}$  in the projective-Euclidean space. **56** #3755  
**Bury, Teresa** (with Jakubowicz, Antoni) Determination of linear connection of mixed, covariantly constant, second order tensor field in two-dimensional space. **56** #13125  
**Hasina, V. I.** Multidimensional three-webs with elastic  $W$ -algebras. (Russian) **55** #1237  
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**Kasperek, Erwin** (with Kurcius, Eryk) Covariant derivative of the second order of scalars. (Polish summary) **55** #3997

- Kurcius, Eryk** See **Kasperek, Erwin**, **55** #3997  
**Morey, P. S., Jr.** Higher degree Jacobian extensors. **55** #3998  
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- Bieszk, Leon** On mixed tensor densities as the algebraic concomitants of the curvature tensor in the two-dimensional space  $L^2$ . **56** #16525  
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**Węgrzynowski, Stefan** Representation of generalized affine symmetric spaces by  $S$ -structures. **55** #6317  
**Zlatanov, G.** Nets in a two-dimensional Weyl space. (Russian) **55** #4000

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## 53B15 Other connections

- Anastasiu, Mihai** Conformal structures on Banach vector bundles. (Romanian summary) (**55** #4250)  
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## 53B20 Local Riemannian geometry

- Amur, Krishna** (with Shetty, D. J.) Geodesic torsions of higher order and their generalization in a subspace of a Riemannian space. **55** #1239  
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**Rathore, Mahendra Pal Singh** (with Mishra, R. S.) On Sasakian manifold with recurrent curvature tensors. **55** #11166  
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**Singh, Udai Pratap** (with Dubey, Shri Krishna Deo) Hyperasymptotic and hypergeodesic curvatures of a curve in special Kawaguchi spaces. (Italian summary) **55** #4006  
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- Vanhecke, Lieven (with Bouten, F.) A generalization of a theorem on tensor fields. 56 #3756
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- Lumiste, Ü. Differential geometry of submanifolds. (Russian) 55 #4008
- Nakao, Zensho Submanifolds of a Riemannian manifold with semisymmetric metric connections. 56 #2758
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- Nediță, N. I. Bi-recurrent Lorentzian manifolds. 55 #4010
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- Rosenbaum, M. See Luehr, C. P.; et al., 56 #6558
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- Vrănceanu, Gheorghe (with Roșca, Radu) ★Introduction in relativity and pseudo-Riemannian geometry. (56 #4694)
- Wünsch, V. Über eine Klasse konforminvarianter Tensoren. 55 #6319

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- Donnini, Stefania Una relazione concernente le connessioni di una varietà quasi hermitiana. (English summary) 56 #3759
- Hervella, Luis (with Vidal, Enrique) Nouvelles géométries pseudo-kähleriennes  $G_1$  et  $G_2$ . (English summary) 55 #4011
- Merenkova, T. N. A classification of the four-dimensional  $H$ -Hermitian spaces. (Russian) 56 #16529
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- Stanilov, Groz'o On Kähler manifolds with vanishing Bochner curvature tensor. 56 #3760
- Vanhecke, Lieven Almost Hermitian manifolds with  $J$ -invariant Riemann curvature tensor. (Italian summary) 55 #8985
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- Yano, Kentaro Totally real submanifolds of a Kaehlerian manifold. 55 #4013
- Note on totally real submanifolds of a Kaehlerian manifold. 56 #3761

## 53B40 Finsler spaces and generalizations (areal metrics)

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- Dubey, Shri Krishna Deo See Singh, Udai Pratap, 56 #16534
- Gama, Masao On a concurrent vector field on an areal space of the submetric class. 55 #4014
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- Ichijyō, Yoshihiro Finsler manifolds modeled on a Minkowski space. 55 #4015
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- Jakál, L. Über äquivalente parametervariante Variations-probleme erster Ordnung. (56 #3707)
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- Wason, James R. Minimal embeddings of the torus in 3-manifolds. 55 #4056
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- Yau, Shing Tung See Cheng, Shiu Yuen, 55 #4045
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- Aminov, Ju. A. The instability of a minimal surface in an  $n$ -dimensional Riemannian space of positive curvature. (Russian) 55 #11175
- Anderson, Robert V. See DeCicco, John, 55 #6338
- Artykbaev, A. Reconstruction of convex surfaces from their extrinsic curvature in spaces with projective metrics. (Russian) 55 #11176
- Blind, Roswitha Eine Charakterisierung der Sphäre im  $E^3$ . (English summary) 56 #13133
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- Černis, G. M. A test of the rigidity of a convex surface of revolution under conical sliding constraints. (Russian) 55 #11177
- Cheng, Shiu Yuen (with Yau, Shing Tung) On the regularity of the Monge-Ampère equation  $\det(\partial^2 u / \partial x_i \partial x_j) = F(x, u)$ . (55 #10727)
- DeCicco, John (with Anderson, Robert V.) Conformal perspectivities upon a hypersphere. 55 #6338
- Derdziński, Andrzej On some condition for a submanifold of Euclidean space to be a sphere. 55 #4057
- Dzan, Jin Jee Four vertices theorem on the sphere  $S^2$ . 56 #16546
- Finn, Robert (with Giusti, Enrico) On nonparametric surfaces of constant mean curvature. 55 #4058



- Firey, William J.** Some open questions on convex surfaces. **55** #4059
- Fomenko, V. T.** (with Klimentov, S. B.) Rigidity of closed surfaces of genus  $p > 1$  and of positive extrinsic curvature. (Russian) **56** #1236
- Gackstatter, Fritz** (with Kunert, Rainer) Konstruktion vollständiger Minimalflächen von endlicher Gesamtkrümmung. **56** #6573
- Gadžimuradov, M. A.** Boundedness of the extrinsic curvature of a smooth contracting surface. (Russian) **56** #9464
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- Mihailovs'kii, V. I.** (with Mihailovs'ka, N. O.) Infinitesimal bendings of developable surfaces with a given direction of displacement of the points of a curve. (Ukrainian. English and Russian summaries) **55** #8999
- Radčenko, M. N.** The structure of deformation fields on a zone of a right circular cylinder. (Ukrainian. English and Russian summaries) **55** #4062
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- Usov, V. V.** The three-dimensional swerve of curves on convex surfaces. (Russian) **56** #1237
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- Zil'berberg, A. A.** The existence of closed convex pyramidal polyhedra with arbitrarily prescribed curvatures of the vertices. (Russian) **56** #9465
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- 53C50** Lorentz manifolds, manifolds with indefinite metrics
- Bancel, Daniel** Une remarque sur la stabilité des hypersurfaces maximales d'un espace lorentzien. (English summary) (**55** #13473)
- Cahen, Michel** (with Kerbrat, Yvan) Transformations conformes des espaces symétriques pseudo-riemanniens. (English summary) **56** #3777
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- Cheng, Shiu Yuen** (with Yau, Shing Tung) Maximal space-like hypersurfaces in the Lorentz-Minkowski spaces. **55** #4063
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- Crumeyrolle, Albert** Spin fibrations over manifolds and generalised twistors. **55** #13349
- Dhooghe, P. F. J.** Generic singularities of 2-dimensional subspaces of Minkowski space. **56** #6577
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- Johnson, Russell A.** The bundle boundary in some special cases. **56** #6578
- Kamyšanskii, N. R.** A classification of the complete and simply connected pseudo-Riemannian spaces  $V^n$ ,  $n > 3$ , that contain at least one pole. (Russian) **56** #1238
- Kerbrat, Yvan** (with Cahen, Michel; Praet, G.) Complétions équivariantes conformes d'espaces lorentziens symétriques. **55** #9002
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- Kuchař, Karel** Geometry of hyperspace. I. (**55** #6464)
- Kinematics of tensor fields in hyperspace. II. (**55** #6465)
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- (with Vanhecke, Lieven) Sur une variété presque paracokählérienne munie d'une connexion self-orthogonale involutive. **55** #9003
- Schimming, R.** Huygens hyperbolic second order differential equations for multi-component fields. (Russian) **55** #16714
- Sokolov, D. D.** Certain properties of an indefinite metric. (Russian) **56** #9466
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- Verstraelen, L.** On a class of completely tangentially pseudo-null immersions into pseudo-Euclidean spaces. **55** #9004
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### 53C55 Hermitian and Kählerian structures [See also 58B20.]

- Adachi, Masahisa** A note on complex structures on open manifolds. (**55** #8400)
- Barros, Manuel** (with Martinez Naveira, Antonio) Décomposition des variétés presque kählériennes vérifiant la deuxième condition de courbure. (English summary) **55** #13351
- Blair, David E.** (with Showers, D. K.) A note on quaternionic geometry. **55** #13352
- Chen, Bang Yen** On Todd genus of 3-dimensional complex manifolds. (**55** #5905)
- (with Ogiue, Koichi) Compact Kaehler manifolds with constant generalized scalar curvature. **55** #4066
- Extrinsic spheres in Kähler manifolds. **56** #6580a
- On Einstein-Kaehler surfaces. (**55** #3332)
- Extrinsic spheres in Kähler manifolds. II. **56** #6580b
- Girbau, Joan** Sur le théorème de Le Potier d'annulation de la cohomologie. (English summary) (**55** #3338)
- Gray, Alfred** Curvature identities for Hermitian and almost Hermitian manifolds. **55** #9005
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- Itoh, Mitsuhiro** A fixed point theorem for Kähler manifolds with positive holomorphic sectional curvature. **56** #1239
- Klembeck, Paul F.** A complete Kähler metric of positive curvature on  $C^n$ . (**56** #676)
- Lata, Sneha** See **Prakash, Nirmala**, **55** #4069
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- Satō, Ikuo** On structures of tangent sphere bundles. **55** #4070
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- Mean curvatures for holomorphic  $2p$ -planes in some almost Hermitian manifolds. **55** #4072
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- Vauthier, Jacques** Théorèmes d'annulation sur certaines variétés ouvertes. (English summary) (**55** #5908)
- Watanabe, Yoshiyuki** On the characteristic functions of quaternion Kählerian spaces of constant  $Q$ -sectional curvature. **55** #4073
- Wolf, Joseph A.** On Calabi's inhomogeneous Einstein-Kaehler manifolds. **56** #1242
- Yang, Paul C.** Kähler metrics on fibered manifolds. **55** #9007
- Yau, Shing Tung** Calabi's conjecture and some new results in algebraic geometry. **56** #9467

### 53C60 Finsler spaces and generalizations (areal metrics) [See also 58B20.]

- Akbar-Zadeh, Hassan** Remarques sur les isométries infinitésimales d'une variété finlérienne compacte. (English summary) **55** #1259
- Brickell, F.** Area measures on a real vector space. **55** #11180
- Diaz, Jean-Guy** (with Grangier, Gérard) Courbure et holonomie des variétés finlériennes. **55** #4074
- Grangier, Gérard** See **Diaz, Jean-Guy**, **55** #4074
- Prasad, Baij Nath** The Lie derivatives and areal motion in areal space. **56** #3780
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- Vasil'eva, M. V.** \*Бесконечные группы Ли и их геометрические приложения. (Russian) [Infinite Lie groups and their geometric applications] (**55** #4309)
- Global analysis and its applications** See **Brickell, F.**, **55** #11180

### 53C65 Integral geometry, differential forms, currents, etc.

- Ambarcumjan, R. V.** (with Oganjan, V. K.) Homogeneous and isotropic random fields of threads on the plane. (Russian. Armenian and English summaries) (**56** #1402)
- Bokowski, Jürgen** (with Haddad, A. H.; Wills, J. M.) Eine Erweiterung der Croftonschen Formeln für konvexe Körper. (**55** #3965)
- Chen, Kuo-Tsai** Extension of  $C^\infty$  function algebra by integrals and Malcev completion of  $\pi_1$ . (**56** #16664)
- Gel'fand, I. M.** (with Gindikin, S. G.) Nonlocal inversion formulas in real integral geometry. (Russian) (**56** #16265)
- Gindikin, S. G.** See **Gel'fand, I. M.**, (**56** #16265)
- Haddad, A. H.** See **Bokowski, Jürgen**; et al., (**55** #3965)
- (Kac, Mark) See **Santaló, Luis A.**, **55** #6340
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- Oganjan, V. K.** See **Ambarcumjan, R. V.**, (**56** #1402)
- Ruben, Harold** The volume of a random simplex in an  $n$ -ball is asymptotically normal. (**56** #6785)



- Santaló, Luis A. ★Integral geometry and geometric probability. 55 #6340  
 Schneider, Rolf Eine kinematische Integralförmel für konvexe Körper. 55 #11181  
 Uspenskii, S. V. The reconstruction of a function given by integrals over a family of conic surfaces. (Russian) 56 #6581  
 Wills, J. M. See Bokowski, Jürgen; et al., (55 #3965)

### 53C70 Direct methods ( $G$ -spaces of Busemann, etc.)

- Berestovskii, V. N. On a condition for the existence of the curvature tensor. (Russian) 56 #6582  
 On the problem of the finite dimensionality of a Busemann  $G$ -space. (Russian) 56 #1243  
 Busemann, Herbert Spaces with distinguished shortest joins. 55 #4077  
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 Park, R. (with Turgeon, J.) Lines meeting four tangents of a curve of order three in 3-space. 55 #1261  
 Robertson, S. A. Mobility in categories and metric spaces. 55 #9008  
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### 53C75 Geometric orders, order geometry

- Lane, Norman D. (with Scherk, Peter; Turgeon, Jean M.) Quasigraphs. 56 #6583  
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### 53C99 None of the above, but in this section

## 54-XX GENERAL TOPOLOGY [For the topology of manifolds of all dimensions, see 57Axx.]

### 54-01 Elementary exposition (collegiate level)

- Arhangel'skii, A. V. (with Ponomarev, V. I.) ★Основы общей топологии в задачах и упражнениях. (Russian) [Fundamentals of general topology through problems and exercises] 56 #3781  
 Faisant, Alain ★TP et TD de topologie générale. 55 #13354  
 Kaplansky, Irving ★Set theory and metric spaces. (56 #11795)  
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 Kasriel, Robert H. ★Undergraduate topology. 55 #4078  
 Ponomarev, V. I. See Arhangel'skii, A. V., 56 #3781  
 Sutherland, W. A. ★Introduction to metric and topological spaces. 56 #1244  
 Wilansky, Albert ★Topology for analysis. 56 #9468

### 54-02 Advanced exposition (research surveys, etc.)

- Comfort, W. W. Ultrafilters: some old and some new results. 56 #13136  
 Eisenberg, Murray ★Topology. 56 #13135  
 Nyikos, Peter J. A survey of zero-dimensional spaces. 56 #1245  
 Conference:  
 NSF-CBMS Regional, Topology ★{Special issue}. 55 #11182  
 Knoxville, Tenn. See Conference: NSF-CBMS Regional, Topology, 55 #11182  
 Topology See Conference: NSF-CBMS Regional, Topology, 55 #11182

### 54-03 Historical

- Aleksandrov, P. S. A. N. Tihonov's principal topological discoveries. (Russian) 56 #6584  
 (Tihonov, A. N.) See Aleksandrov, P. S., 56 #6584

### 54-04 Explicit machine computation and programs (not the theory of computation or programming)

### 54-06 Collections of papers; proceedings of conferences

- (Kuperberg, Włodzimierz) See Proceedings: Topology, 56 #1246  
 (Novák, Josef) See General topology and its relations to modern analysis and algebra, 56 #3782 and General topology and its relations to modern analysis and algebra, 56 #6585  
 (Reed, George M.) See Set-theoretic topology, 55 #4079 and Proceedings: Topology, 56 #1246  
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## 54Axx Generalities

- (Rjabuhin, Ju. M.) See Topological structures and algebraic systems, (56 #12165)  
 Algebraic systems See Topological structures and algebraic systems, (56 #12165)  
 Topological structures and algebraic systems ★Топологические структуры и алгебраические системы. (Russian) [Topological structures and algebraic systems] (56 #12165)

### 54A05 Topological spaces and generalizations (closure spaces, etc.)

- Agami, Raga Muhammed Baha el-Din Uniformly continuous homomorphisms of abstract Boolean algebras. (Russian. Azerbaijani and English summaries) (56 #5383)  
 Butnariu, Dan  $L$ -fuzzy topologies. 55 #11183  
 Christoph, F. T. Quotient fuzzy topology and local compactness. 55 #13355  
 Chvalina, Jan Concerning a non-realizability of connected compact semi-separated closure operations by set-systems. 55 #11184  
 On homeomorphic topologies and equivalent set-systems. 55 #11185  
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 Frič, Roman (with Koutnik, V.) Sequentially complete spaces. 56 #13137  
 Herrlich, Horst ★Some topological theorems which fail to be true. (55 #9024)  
 Ignat, Calin Approximation structures, convergence spaces and Katětov's merotopy. (Italian summary) 55 #6341  
 Istrătescu, Ana I. On a generalization of probabilistic metric spaces. II. 56 #13138  
 Katětov, Miroslav Spaces defined by giving a family of centered systems. (Russian) 56 #6586  
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 Koutnik, V. See Frič, Roman, 56 #13137  
 Kumar, Vinod On the largest Hausdorff compactification of a Hausdorff convergence space. (56 #9490)  
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 Lowen, Robert Fuzzy topological spaces and fuzzy compactness. 55 #13357  
 Initial and final fuzzy topologies and the fuzzy Tychonoff theorem. 55 #13358  
 Ludescher, Helmuth (with Rovența, Eugen) Nuanced neighborhoods in fuzzy topological spaces. (Romanian. English summary) 56 #16548  
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 Smithson, R. E. See Seelbach, E. R., (55 #13376)  
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 Warren, Richard H. Boundary of a fuzzy set. 55 #13359  
 Wyler, Oswald Are there topoi in topology? 56 #16549

### 54A10 Change of topology, comparison of topologies

- Gähler, Siegfried Modifizierte Topologien und deren Anwendungen. 55 #4080  
 $m$ -Verfeinerungen von Topologien und verallgemeinerte topologische Vektorräume. (55 #6162)  
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 Malyhin, V. I. The lattice of regular topologies on a countable set is complemented. (Russian) 56 #1248  
 Pytkeev, E. G. The upper bounds of topologies. (Russian) 55 #1262  
 Reynolds, Donald F. Simple extensions of topologies 55 #1263  
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 Stone, H. E. See Guthrie, J. A., 56 #1247

### 54A15 Syntopogeneous structures

- Burgess, D. C. J. (with Fitzpatrick, M.) A note on separation axioms for compact syntopogenous spaces. 55 #9010  
 (with Fitzpatrick, M.) Syntopogenous preordered spaces. II. 56 #16550  
 Fitzpatrick, M. See Burgess, D. C. J., 55 #9010 and Burgess, D. C. J., 56 #16550  
 Forelli, Frank Fourier theory and flows. (55 #1071)  
 Iseki, Kiyoshi On Hacqué  $T$ -mappings. (55 #4101)

### 54A20 Convergence (general theory) and limits

- Brunet, Bernard Sur la classe des morphismes propres dans la catégorie des espaces de convergence. (English summary) 55 #1264  
 de Bruyn, G. F. C. Concepts in vector spaces with convergence structures. (55 #13204)  
 Cerruti, Umberto Strutture di convergenza e spazi  $\omega_\mu$  metrizzabili. (English summary) 55 #11186  
 De Giorgi, Ennio  $\Gamma$ -convergenza e  $G$ -convergenza. (English summary) 56 #16551  
 Frič, Roman On  $E$ -sequentially regular spaces. 55 #1265  
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- Kasahara, Shouro** Boundedness in convergence spaces. **55** #1267  
Characterizations of convergence structures. **55** #6342
- Kelder, T.** Convergence by means of nets. (Russian. Estonian and German summaries) **55** #4081
- Kent, D. C.** (with Gazik, R. J.) Minimal uniform convergence spaces. **55** #4082  
(with Richardson, Gary D.) The regularity series of a convergence space. II. **55** #6343
- Kratochvíl, P.** A sequential decomposition of filters. **56** #16552
- Lee, R. S.** The category of uniform convergence spaces is Cartesian closed. **55** #4083
- Lowen-Colebunders, E.** Completeness properties for convergence spaces. **55** #4084
- Müller, Günter** Über die Sonderstellung zweier allgemeiner Konvergenzbegriffe. **56** #6587
- Niechajewicz, Romana** Sets of limit points of compact sequences in metric spaces. (Russian summary) **56** #9470
- Pap, Endre** The general theory on convergence of the relation-continuous sequences and its applications. **55** #11188
- Rao, C. J. M.** On  $m$ -ultracompactifications. **55** #4085
- Renz, Wolfgang** Summe von Adhärenzräumen. **55** #13360
- Richardson, Gary D.** See **Kent, D. C.**, **55** #6343
- Riecke, C. V.** Self-maps on convergence spaces. **55** #4086  
Complementation in the lattice of convergence structures. **55** #13361
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- Schroder, M.** Marinescu structures and  $C$ -spaces. (**55** #4097)  
Compactness theorems. **55** #11189
- Thompson, Travis** Concerning certain subsets of non-Hausdorff topological spaces. (Italian summary) **55** #6344
- Vaughan, J. E.** Total nets and filters. **55** #1268
- Washihara, Masako** On convergence structure in a ranked space. **55** #4087

#### 54A25 Cardinality properties (discrete subsets, weight, etc.)

- Antonovskii, M. Ja.** (with Boltjanskii, V. G.) Tihonov semifields and certain problems of general topology. (Russian) (**56** #8638a)  
(with Choodnovsky, David V.) Certain questions of general topology, and Tihonov semifields. II. (Russian) (**56** #8638b)
- Arhangel'skii, A. V.** A survey of some recent advances in general topology, old and new problems. **55** #1269  
Bicompacta, and unions of countable families of metrizable spaces. (Russian) **55** #6345
- Boltjanskii, V. G.** The metrization of spaces of different weight. (Russian. Georgian summary) (**55** #6372)  
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- Charlesworth, Arthur** On the cardinality of a topological space. **56** #9471
- Choodnovsky, David V.** See **Antonovskii, M. Ja.**, (**56** #8638b)
- Comfort, W. W.** (with Itzkowitz, G. L.) Density character in topological groups. (**56** #5767)  
(with Retta, Teklehaimanot) The density character of unions. **56** #3783
- Fleissner, William G.** The character of  $\omega_1$  in first countable spaces. **55** #11190
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- Agoston, Max K. \*Algebraic topology: a first course. 56 #3825
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## 55–02 Advanced exposition (research surveys, etc.)

- Milnor, John W.** (with **Stasheff, James D.**) ★Characteristic classes. (**55** #13428)
- Stasheff, James D.** See **Milnor, John W.**, (**55** #13428)

## 55–03 Historical

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- Hilton, Peter** Some contributions of Beno Eckmann to the development of topology and related fields. (**56** #15326)
- Bibliography:**  
**Eckmann, Beno** See **Hilton, Peter**, (**56** #15326)

## 55–04 Explicit machine computation and programs (not the theory of computation or programming)

## 55–06 Collections of papers; proceedings of conferences

- (Morrel, Bernard B.)** See *K*-theory and operator algebras, (**56** #15254)
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### 55A05 Fundamental group, presentations, free differential calculus [See also 20E40.]

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- Heil, Wolfgang H.** Some finitely presented non-3-manifold groups. **55** #11236
- Johnson, F. E. A.** On the first end invariant of an exact sequence. (**55** #515)
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- Fisk, Steve** Variations on coloring, surfaces and higher-dimensional manifolds. (**56** #13221)
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### 55A20 Two-dimensional complexes

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- Wright, Perrin** Covering 2-dimensional polyhedra by 3-manifold spines. **56** #16611

### 55A25 Knots and links [For the high-dimensional case, see 57C45.]

- Cowan, Thaddeus M.** Supplementary report: braids, side segments, and impossible figures. **56** #16612
- Crowell, Richard H.** (with **Fox, Ralph H.**) ★Introduction to knot theory. **56** #3829
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### 55A30 Wild knots and surfaces, etc.

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### 55A99 None of the above, but in this section

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 Ruiz Salguero, Carlos (with Ruiz, R.) Any equivalence relation over a category is a simplicial homotopy. (**56** #5687)

## 55J15 Chain complexes

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 Jansen, A. V. Chain complexes from *g*-functions. **55** #1356  
 Kumar, Kiran Homotopy and tensor product. **55** #13426  
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## 55J20 Universal coefficient theorems, Bockstein operator

- Ruiz Salguero, Carlos ★Cohomologie à coefficients dans un presque-groupe simplicial et *K*-théorie algébrique. **56** #3841

## 55J25 Homology of a product, Künneth formula

- Katz, Elyahu A Künneth formula for coproducts of simplicial groups. **56** #3842

## 55J30 Duality

## 55J99 None of the above, but in this section

- Brown, Ronald (with Spencer, Christopher B.) Double groupoids and crossed modules. **55** #13427  
 Spencer, Christopher B. See Brown, Ronald, **55** #13427

## 57–XX MANIFOLDS AND CELL COMPLEXES [For complex manifolds, see 32C10.]

## 57–01 Elementary exposition (collegiate level)

- Milnor, John W. (with Stasheff, James D.) ★Characteristic classes. **55** #13428  
 Stasheff, James D. See Milnor, John W., **55** #13428  
 Wallace, Andrew H. ★Differential topology: first steps. **55** #9098

## 57–02 Advanced exposition (research surveys, etc.)

- Rowlett, Russell J. Problem session. **56** #1314

## 57–03 Historical

## 57–04 Explicit machine computation and programs (not the theory of computation or programming)

## 57–06 Collections of papers; proceedings of conferences

- (Burlat, O.) See Singularités d'applications différentiables, (**55** #11287)  
 (do Carmo, Manfredo Perdigão) See Geometry and topology, (**56** #11)  
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 Latin American, Mathematics See Geometry and topology, (**56** #11)  
 Mathematical Десятая математическая школа (пос. Кахавели/Нальчик, 1972 г.). (Russian) [Tenth Mathematical School (Kaciveli/Nalchik, 1972)] (**56** #15261)



## Séminaire:

**Singularités d'Applications Différentiables** *See Singularités d'applications différentiables*, (55 #11287)

**Singularités d'applications différentiables** ★*Singularités d'applications différentiables*. (55 #11287)

**Studies in topology** ★Исследования по топологии. ИИ. (Russian) [Studies in topology. II] A collection of articles edited by A. A. Ivanov. 55 #9097

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**Topology** *See Studies in topology*, 55 #9097 *and Geometry and topology*, (56 #11)

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**Fisk, Steve** Variations on coloring, surfaces and higher-dimensional manifolds. 56 #13221

**Harary, Frank** (*with* Rosen, Ronald H.) On the planarity of 2-complexes. (55 #10304)

**Hirsch, Ulrich** Offene Abbildungen von Flächen auf die 2-Sphäre mit minimalem Defekt. 55 #4175

**Kronheimer, E. H.** Spheres which look round all round are round. (55 #6381)

**Manukjan, S. N.** Some properties of partitionings of the plane by nondegenerate constructive curves. (Russian. Armenian summary) (56 #5239)

**Metzler, Wolfgang** Über den Homotopietyp zweidimensionaler CW-Komplexe und Elementartransformationen bei Darstellungen von Gruppen durch Erzeugende und definierende Relationen. (55 #13402)

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**Rosen, Ronald H.** *See Harary, Frank*, (55 #10304)

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**Vincent, Paul A.** A metrization theorem for 2-manifolds. 55 #13430

**Wright, Perrin** Covering 2-dimensional polyhedra by 3-manifold spines. (56 #16611)

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**Birman, Joan S.** (*with* González-Acuña, F.; Montesinos Amilibia, José María) Heegaard splittings of prime 3-manifolds are not unique. 55 #4177

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**Burns, Robert G.** (*with* Edmunds, Charles C.; Formanek, Edward) The equation  $s^{-1}t^{-1}st = u^{-1}v^{-1}uv$  in a free product of groups. (55 #12820)

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**Feustel, C. D.** Elements in  $\pi_1(\partial M^3)$  that are represented by simple loops. 56 #9533

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**Gusevskii, N. A.** A problem in the theory of Kleinian groups. (Russian) 56 #16632

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Obstruction theory in 3-dimensional topology: an extension theorem. 56 #13222

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**Jaco, William** (*with* Shalen, Peter B.) Peripheral structure of 3-manifolds. 55 #1357

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**Patkowska, H.** A class  $\alpha$  and compacta which are quasi-homeomorphic with surfaces. 56 #16633

**Scott, G. Peter** Fundamental groups of non-compact 3-manifolds. (56 #6640)

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**Simon, Jonathan** Compactification of covering spaces of compact 3-manifolds. 55 #4178

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**Tucker, Thomas W.** On the Fox-Artin sphere and surfaces in noncompact 3-manifolds. 56 #6662

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**Zieschang, H.** Triangular groups. (Russian) (56 #15789)

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**Bierman, Orville** A monotone intersection property for manifolds. 55 #4180

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**Rochowski, M.** Chord-decreasing homeomorphisms in Euclidean spaces. 56 #16635

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## 57A20 Topology of infinite-dimensional manifolds [See also 58Bxx.]

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## 57A35 Imbeddings and immersions

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**Černavskii, A. V.** Espace de plongements. 55 #6435

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- 57A40 Neighborhoods of submanifolds
- 57A45 Flatness
- Venema, Gerard A. Weak flatness for shape classes of sphere-like continua. **56** #9535
- 57A50  $S^{n-1} \subset E^n$ , Schoenflies problem
- 57A55 Microbundles
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- 57A60 Cellularity
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- 57A65 Algebraic topology of manifolds
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- Hejny, Milan Klein hyperbottle. **55** #6437
- Laudenbach, François Formes différentielles de degré 1 fermées non singulières: classes d'homotopie de leurs noyaux. (**55** #1360)

- 57A70 Cobordism
- Heitz, Raymond Sur les groupes  $K_{\text{Top}}(S_n)$ . (**56** #16639)
- Szücs, A. Cobordism groups of  $l$ -immersions. II. (Russian) **55** #13432

- 57A99 None of the above, but in this section
- Hussein, S. Y. The products of manifolds with the f.p.p. need not have the f.p.p. (**56** #13203)

## 57Bxx Generalized manifolds [See also 18F15.]

- 57B05 Local properties
- 57B10 Poincaré duality spaces
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- Brumfiel, Gregory W. (with Morgan, John W.) Homotopy theoretic consequences of N. Levitt's obstruction theory to transversality for spherical fibrations. **55** #4187
- Freedman, Michael H. (with Taylor, Lawrence)  $\Lambda$ -splitting 4-manifolds. (**56** #1329)
- McCroly, Clint A characterization of homology manifolds. **56** #3846
- Morgan, John W. See Brumfiel, Gregory W., **55** #4187
- Schafer, James A. Poincaré complexes and one-relator groups. (**56** #15791)
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- Takahashi, Hideo Degrees of maps and homotopy type. (**55** #9077)
- Taylor, Lawrence See Freedman, Michael H., (**56** #1329)

- 57B99 None of the above, but in this section

- Galewski, David E. (with Stern, Ronald J.) The relationship between homology and topological manifolds via homology transversality. (**56** #3847)
- Morel, Francis Type d'homotopie rationnelle des  $Q$ -variétés et formes simpliciales basiques. (English summary) (**56** #1326)
- Scharlemann, Martin Thoroughly knotted homology spheres. (**56** #1322)
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## 57Cxx PL-topology

- 57C05 The general topology of complexes
- Goresky, Mark (with MacPherson, Robert D.) La dualité de Poincaré pour les espaces singuliers. (English summary) (**55** #13408)
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- MacPherson, Robert D. See Goresky, Mark, (**55** #13408)
- Skordev, Genčo S. Rouché's theorem. (Russian. English summary) (**55** #4199)

- 57C10 Simple homotopy type, Whitehead torsion, Reidemeister-Franz torsion, etc.

- Bak, Anthony The involution on Whitehead torsion. **56** #9536
- Chapman, T. A. Topological classification of simple homotopy equivalences. **55** #4188
- Cohen, Marshall M. Whitehead torsion, group extensions, and Zeeman's conjecture in high dimensions. **55** #9105
- Loday, Jean-Louis  $K$ -théorie algébrique et représentations de groupes. (**56** #5686)
- Siebenmann, Laurent L'invariance topologique du type simple d'homotopie (d'après T. Chapman et R. D. Edwards). (**55** #9103)
- Turaev, V. G. Reidemeister torsion and the Alexander polynomial. (Russian) **55** #6438
- Reidemeister torsion and group invariants of three-dimensional manifolds. (Russian. English summary) **55** #13433

## 57C15 Triangulating manifolds

- Bognár, M. A finite 2-dimensional CW complex which cannot be triangulated. **55** #9106
- Ferri, Massimo (with Gagliardi, Carlo) Alcune proprietà caratteristiche delle triangolazioni contratte. (English summary) **55** #9107
- Una rappresentazione delle  $n$ -varietà topologiche triangolabili mediante grafi  $(n+1)$ -colorati. (English summary) **55** #1361
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- Stanley, Richard P. The upper bound conjecture and Cohen-Macaulay rings. **56** #16640
- Vo-Thanh-Liem Some cellular subsets of the spheres. **56** #16641

## 57C20 Cobordism

- Dominguez Murillo, Eladio Pseudocobordism groups. (Spanish) **56** #13226a
- Correction: "Pseudocobordism groups" (Spanish) (Rev. Real Acad. Ci. Exact. Fis. Natur. Madrid **69** (1975), no. 1, 121-147). **56** #13226b
- Hajduk, B. Comparing handle decompositions of homotopy equivalent manifolds. (**56** #9554)

## 57C25 Comparison of PL-structures: classification, Hauptvermutung

- Akbulut, Selman (with King, Henry C.) Real algebraic variety structures on P. L. manifolds. **55** #13434
- Anderson, Douglas R. (with Hsiang, W. C.) The functors  $K_{-1}$  and pseudo-isotopies of polyhedra. (**55** #13447)
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- Stern, Ronald J. Classification theorems for parameterized families of smooth or piecewise linear manifold structures respecting a submanifold. (**55** #6436)
- Sullivan, Dennis Galois symmetry in manifold theory at the primes. (**56** #9541)

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- Buoncrisiano, Sandro Elementary proofs of some results of engulfing theory. (Italian summary) **55** #11260

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- Akiba, Tadatoshi On the  $n$ -parameter concordance and isotopy theorem. **55** #6439
- Cappell, Sylvain E. (with Shaneson, Julius L.) Fundamental groups,  $\Gamma$ -groups, and codimension two submanifolds. **55** #9109
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- Connelly, Robert An immersed polyhedral surface which flexes. **55** #1362
- Galewski, David E. (with Stern, Ronald J.) The relationship between homology and topological manifolds via homology transversality. **56** #3847
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- 57C45 Knots and links (in high dimensions) [for the low-dimensional case, see 55A25.]

- Akbulut, Selman On 2-dimensional homology classes of 4-manifolds. (**55** #6452)
- Gordon, C. McA. Knots in the 4-sphere. **55** #13435
- Kato, Mitsuyoshi Partial Poincaré duality for  $k$ -regular spaces and complex algebraic sets. (**56** #8900)
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- Liang, Chao Chu An algebraic classification of some links of codimension two. **56** #16642
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- Oka, Mutsuo** On the topology of the complement of a hypersurface in  $\mathbf{P}^{n+1}$ . **56** #6667
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- McCrory, Clint** Cone bundles. **55** #11261
- Osborn, Howard** Pontrjagin classes of PL sheaves. (**56** #1324)
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- Venema, Gerard A.** A topological disk in a 4-manifold can be approximated by piecewise linear disks. **55** #4192

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- Strube, Richard F. E.** A map of a polyhedron onto a disk. **56** #6668
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- Yamashita, Masakatsu** (*with* **Ikeda, Hiroshi**) 4-manifolds of covering number 2. **55** #1364

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- Hirsch, Morris W.** ★Differential topology. **56** #6669

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### 57D15 Specialized structures on manifolds (spin manifolds, frame manifolds, etc.)

- Arrowsmith, D. K.** (*with* **Furness, P. M. D.**) Flat affine Klein bottles. (**55** #6334)
- Bérard-Bergery, Lionel** Quelques exemples de variétés riemanniennes où toutes les géodésiques issues d'un point sont fermées et de même longueur, suivies de quelques résultats sur leur topologie. (English summary) (**55** #9124)
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#### 57D70 Critical points and critical submanifolds

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 Gabriélov, A. M. Bifurcations, Dynkin diagrams and the modality of isolated singularities. (Russian) (**55** #12947)  
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#### 57D75 $O$ - and $SO$ -cobordism

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- Royster, David C. Aspherical generators of unoriented cobordism. **56** #6680  
 Stong, R. E. Torsion in manifolds and the semicharacteristic. **55** #4223  
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57D80 *h*- and *s*-cobordism

- Almgren, Frederick J., Jr. (with Thurston, William P.) Examples of unknotted curves which bound only surfaces of high genus within their convex hulls. (**56** #1209)  
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## 57D85 Equivariant cobordism

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 Giambalvo, V. Characteristic numbers and equivariant spin cobordism. **56** #3858  
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 Pitt, David On the complex bordism rings of the generalised quaternion groups. **56** #3860  
 Rowlett, Russell J. Free actions of a  $p$ -group on two generators. **56** #16656  
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 Winkelnkemper, H. E. See Stong, R. E., **56** #13235

## 57D90 Other types of cobordism

- Buhštaber, V. M. (with Miščenko, A. S.; Novikov, S. P.) Formal groups and their role in the apparatus of algebraic topology. (Russian) **56** #3862  
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 Krueger, Warren M. Hopf invariants and Browder's work on the Kervaire invariant problem. (**55** #4173)  
 Lam, Kee Yuen Some interesting examples of nonsingular bilinear maps. (**55** #6425)  
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 Novikov, S. P. See Buhštaber, V. M.; et al., **56** #3862  
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 Porter, Don Correction to: "Symplectic bordism, Stiefel-Whitney numbers, and a Novikov resolution" (Pacific J. Math. **35** (1970), 205–212). **55** #6451  
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 Stong, R. E. Induced cobordism theories—an example. **56** #6683  
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## 57D95 Realizing cycles by submanifolds

- Akbulut, Selman On 2-dimensional homology classes of 4-manifolds. **55** #6452  
 Bennequin, Daniel Sur les représentants lisses des classes d'homologie entière de codimension 1 des variétés. (English summary) **56** #16658  
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## 57D99 None of the above, but in this section

- Banchoff, Thomas F. Self linking numbers of space polygons. **55** #4227

## 57Exx Topological transformation groups [See also 20E40, 22–XX, 54H15, 58D05.]

- (Cole, Michael) See Lichnerowicz, André, **55** #11279  
 Lichnerowicz, André ★Geometry of groups of transformations. **55** #11279

## 57E05 Topological properties of groups of homeomorphisms

- Avérous, Geneviève (with Kobayashi, Shoshichi) On automorphisms of spaces of nonpositive curvature with finite volume. (**56** #1229)  
 Burghlelea, Dan (with Lashof, R.) Stability of concordances and the suspension homeomorphism. **55** #11280  
 On the decomposition of the automorphisms-group of  $M \times S^1$ . **55** #11281a  
 The structure of block-automorphisms of  $M \times S^1$ . **55** #11281b  
 Eells, James, Jr. Fibring spaces of maps. (**55** #4264)  
 Erle, Dieter On groups of linear, smooth, and topological equivariant automorphisms. **55** #13454  
 Fathi, Albert (with Visetti, Yves-Marie) Structure du groupe des homéomorphismes préservant une mesure sur une variété compacte. (English summary) **55** #6453  
 Gauld, David B. Local contractibility of  $\text{PL}(M)$  for a compact manifold. **55** #4228  
 Karube, Takashi A simple proof that the space of orientation preserving transformations of an interval is homeomorphic to  $I_2$ . **56** #3865  
 Hilbert subgroups of the full homeomorphism group of a topological group. **55** #13455  
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 Lashof, R. See Burghlelea, Dan, **55** #11280  
 MacLachlan, C. Note on the Hurwitz-Nielsen realisation problem. (**56** #1303)  
 Schneider, Hans (with Wells, R.) A note on the concordance homotopy group of real projective space. **55** #4229  
 Schultz, Reinhard Closed curves and circle homomorphisms in groups of diffeomorphisms. **55** #9126  
 Visetti, Yves-Marie See Fathi, Albert, **55** #6453  
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## 57E10 Compact groups of homeomorphisms

- Allday, Christopher The rational homotopy of fixed point sets of torus actions. **55** #4230  
 Edmonds, Allan L. Taming free circle actions. **55** #4231  
 Jackowski, Stefan Equivariant  $K$ -theory and cyclic subgroups. **56** #6684  
 Mather, John N. Differentiable invariants. (**55** #9152)  
 Pao, Peter Sie The topological structure of 4-manifolds with effective torus actions. I. **55** #4232  
 Rais, Mustapha Action de certains groupes dans des espaces de fonctions  $C^\infty$ . (**55** #9153)  
 Yau, Shing Tung Remarks on the group of isometries of a Riemannian manifold. (**56** #6686)

## 57E15 Compact Lie groups of differentiable transformations

- Asoh, Tohl Smooth  $S^3$ -actions on  $n$  manifolds for  $n < 4$ . **56** #6685  
 Brown, Robert F. Fixed points of automorphisms of compact Lie groups. **55** #1372  
 Davis, Michael Examples of actions on manifolds almost diffeomorphic to  $V_{n+1,2}$ . **55** #4233  
 (with Hsiang, W. C.) Concordance classes of regular  $U_n$  and  $\text{Sp}_n$  action on homotopy spheres. **55** #11282  
 le Dimet, Jean-Yves  $G$ -variétés topologiques et  $G$ -microfibrés. (**56** #3845)  
 Ewing, John Spheres as fixed point sets. **55** #4234  
 Field, M. J. Singularity theory and equivariant dynamical systems. (**56** #6739)  
 Transversality in  $G$ -manifolds. (**56** #9563)  
 Gordon, Robin A. The Burnside ring of a cyclic extension of a torus. **56** #1332  
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 Morton, H. R. Some unexpectedly non-singular orbit spaces. **55** #11283  
 Nagano, Tadashi On compact transformation groups. **56** #13237  
 Petrie, Ted Equivariant quasi-equivalence, transversality and normal cobordism. **55** #4235  
 Ronga, F. Stabilité locale des applications équivariantes. **56** #3866  
 Schwarz, Gerald W. Covering smooth homotopies of orbit spaces. (**56** #6707)  
 Stein, Elliott On the orbit types in a circle action. **56** #9558  
 Stong, R. E. Free  $S^1$  actions. (**55** #4225)  
 Tomter, Per Orbit structure for Lie group actions on higher cohomology projective spaces. (**56** #13242)

## 57E20 Noncompact Lie groups of transformations

- Lapkovskii, A. K. (with Laptinskii, V. N.) On the theory of contact of plane figures in a homogeneous space of a linear group. (Russian) **56** #13238



Laptinskii, V. N. *See* Lapkovskii, A. K., **56** #13238  
 Strantzalos, P. *H*-transversale Aktionen auf Riemannschen Mannigfaltigkeiten. **55** #4236  
 Yau, Shing Tung Remarks on the group of isometries of a Riemannian manifold. **56** #6686

57E25 Groups acting on specific manifolds

Chang, Theodore (*with* Skjelbred, Tor) Lie group actions on a Cayley projective plane and a note on homogeneous spaces of prime Euler characteristic. **55** #1371  
 Clark, Bradd E. *See* Ritter, Gerhard X., **56** #6688  
 Davis, Michael Examples of actions on manifolds almost diffeomorphic to  $V_{n+1,2}$ . (**55** #4233)  
 Fintushel, Ronald Circle actions on simply connected 4-manifolds. **56** #16659  
 de la Harpe, Pierre On noncompact Lie groups acting transitively on spheres. (Russian summary) **56** #13239  
 Iberkleid, Wolf (*with* Petrie, Ted)  $\star$ Smooth  $S^1$  manifolds. **56** #3867  
 Igawa, Akira (*with* Watabe, Tsuyoshi) A note on  $SO(3)$ -action on  $CP_3$ . **56** #13240  
 Liang, Chao Chu Involutions on homotopy spheres and their gluing diffeomorphisms. (**55** #4215a)  
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 Yoshida, Tomoyoshi On smooth semifree  $S^1$  actions on cohomology complex projective spaces. **56** #3868

57E30 Discontinuous groups of transformations

Zieschang, H. Triangular groups. (Russian) (**56** #15789)

57E99 None of the above, but in this section

Pixton, Dennis Nonsmoothable, unstable group actions. (**55** #11310)  
 Stong, R. E. (*with* Winkelnkemper, H. E.) Locally free actions and Stiefel-Whitney numbers. II. (**56** #13235)  
 Winkelnkemper, H. E. *See* Stong, R. E., (**56** #13235)

**57Fxx Homology and homotopy of topological groups and related structures**

57F05 Hopf algebras [See also 16A24.]

Baues, Hans Joachim (*with* Lemaire, Jean-Michel) Minimal models in homotopy theory. (**55** #4174)  
 Lemaire, Jean-Michel *See* Baues, Hans Joachim, (**55** #4174)  
 McNaughton, J. M. A note on cocycle twisted rings of differential operators. (**56** #5524)  
 Moore, John C. Differential homological algebra. (**55** #9128)  
 Yanagida, Syun-ichi The additive structure of  $G^*(L^n(P^k))$ . (**55** #4146)

57F10 Homology of Lie groups

Brown, Robert F. Cohomology of homomorphisms of Lie algebras and Lie groups. **56** #3869  
 Cathelineau, J.-L. Sur un théorème d'intégralité de B. Kostant. (**56** #5791)  
 Doçițoiu, Constantin Sur les générateurs des groupes d'homologie et cohomologie singulière des variétés grassmanniennes réelles. **56** #9559  
 Kono, Akira (*with* Mimura, Mamoru) Cohomology operations and the Hopf algebra structures of the compact, exceptional Lie groups  $E_7$  and  $E_8$ . **56** #13243  
 Marchiafava, Stefano (*with* Romani, Giuliano) Sul classificante del gruppo  $Sp(n) \cdot Sp(1)$ . **55** #6454  
 May, J. Peter (*with* Zabrodsky, Alexander)  $H^*\text{spin}(n)$  as a Hopf algebra. (**56** #13220)  
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57F15 Homology of homogeneous spaces of Lie groups

Bernšteín, I. N. (*with* Gel'fand, I. M.; Gel'fand, S. I.) Schubert cells, and the cohomology of the spaces  $G/P$ . (Russian) (**55** #2941)

Connolly, Frank (*with* Nagano, Tadashi) The intersection pairing on a homogeneous Kähler manifold. **56** #9560  
 tom Dieck, Tammo Orbittypen und äquivariante Homologie. II. **55** #9127  
 Gel'fand, I. M. *See* Bernšteín, I. N.; et al., (**55** #2941)  
 Gel'fand, S. I. *See* Bernšteín, I. N.; et al., (**55** #2941)  
 Ishitoya, Kiminao (*with* Toda, Hiroshi) On the cohomology of irreducible symmetric spaces of exceptional type. **56** #1333  
 Integral cohomology ring of the symmetric space  $EII$ . **56** #1334  
 Lévy-Bruhl-Laperrière, Anne Spectre du de Rham Hodge sur l'espace projectif complexe. (English summary) (**56** #6764)  
 Minami, Haruo  $K$ -groups of  $EIII$  and  $FII$ . **55** #13458  
 Nagano, Tadashi *See* Connolly, Frank, **56** #9560  
 Oproiu, V. Some multiplication formulas in the cohomology ring of the Grassmann manifolds. **56** #1335  
 Some non-embedding theorems for the Grassmann manifolds  $G_{2,n}$  and  $G_{3,n}$ . **56** #3870  
 Ružický, Eugen The incidence submanifold of  $RP^n \times G_1(RP^n)$  for  $n$  odd is nonorientable. **55** #4239  
 Szybiak, A. Grassmannians of higher order and equations of moving frame. (**55** #6335)  
 Toda, Hiroshi *See* Ishitoya, Kiminao, **56** #1333  
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57F20 Homotopy groups of topological groups and homogeneous spaces

Furukawa, Yasukuni *See* Nomura, Yasutoshi, **55** #11285  
 James, I. M.  $\star$ The topology of Stiefel manifolds. **55** #4240  
 Lam, Kee Yuen A formula for the tangent bundle of flag manifolds and related manifolds. (**55** #4196)  
 Nomura, Yasutoshi (*with* Furukawa, Yasukuni) Some homotopy groups of complex Stiefel manifolds  $W_{n,2}$  and  $W_{n,3}$ . **55** #11285  
 Shastri, A. R. On nonapproximability of  $K(\pi, n)$ -spaces by homogeneous spaces. **56** #6689

57F25 Homology of  $H$ -spaces

Kono, Akira A secondary operation of exceptional Lie groups. (**56** #9530)  
 Lin, James P. The loop space problem and its consequences. (**56** #6652)  
 Schultz, Reinhard Corrigenda: "Rational  $H$ -cobordism invariants for lens space bundles" (Quart. J. Math. Oxford Ser. (2) **25** (1974), 497–511). **55** #6455

57F30 Bar and cobar constructions

Moore, John C. Differential homological algebra. **55** #9128

57F35 Applications of Eilenberg-Moore spectral sequences [See also 55F20, 55H20.]

57F99 None of the above, but in this section

Borisovič, Ju. G. (*with* Izrailevič, Ja. A.; Ščelokova, T. N.) On the method of A. Borel's spectral sequence in the theory of equivariant mappings. (Russian) (**55** #13409)  
 Izrailevič, Ja. A. *See* Borisovič, Ju. G.; et al., (**55** #13409)  
 Katz, Elyahu A Künneth formula for coproducts of simplicial groups. (**56** #3842)  
 Ščelokova, T. N. *See* Borisovič, Ju. G.; et al., (**55** #13409)  
 Sullivan, Dennis Genetics of homotopy theory and the Adams conjecture. (**56** #1305)

**58–XX GLOBAL ANALYSIS, ANALYSIS ON MANIFOLDS**  
 [For real-analytic and complex manifolds, see 32Cxx; for geometric integration theory, see 49F20, 49F22.]

58–01 Elementary exposition (collegiate level)

Chillingworth, D. Smooth manifolds and maps. **55** #11286  
 Fowler, D. H. Advanced calculus. (**55** #10610)  
 Hirsch, Morris W.  $\star$ Differential topology. (**56** #6669)  
 Jyoo, Yeong-Heum Study of a variational theory in mathematical physics. (Korean. English summary) (**55** #6480)  
 Lang, Serge  $\star$ Differential manifolds. **55** #4241  
 Radziszewski, Konstanty  $\star$ Wstęp do współczesnej geometrii różniczkowej. (Polish) [Introduction to modern differential geometry] (**55** #3979)  
 Global analysis and its applications *See* Chillingworth, D., **55** #11286 and Fowler, D. H., (**55** #10610)

58–02 Advanced exposition (research surveys, etc.)

Carroll, Robert W.  $\star$ Abstract methods in partial differential equations. **55** #6456  
 Chern, Shiing Shen Differential geometry: its past and its future. (**55** #1242)  
 (Fattorini, H.) *See* Schwartz, Jacob T., **55** #6457  
 Hermann, Robert  $\star$ The geometry of non-linear differential equations, Bäcklund transformations, and solitons. Part A. **56** #1336  
 (Karcher, H.) *See* Schwartz, Jacob T., **55** #6457  
 (Kucharczyk, Piotr) *See* Sulanke, Rolf; et al., **55** #1373  
 (Nirenberg, R.) *See* Schwartz, Jacob T., **55** #6457  
 (Porta, Horacio) *See* Schwartz, Jacob T., **55** #6457  
 Schwartz, Jacob T.  $\star$ Nonlinear functional analysis. **55** #6457  
 Sulanke, Rolf (*with* Wintgen, P.)  $\star$ Geometria różniczkowa i teoria wiązek. (Polish) [Differential geometry and fiber bundles] **55** #1373  
 Wintgen, P. *See* Sulanke, Rolf, **55** #1373



- 58-03 Historical
- 58-04 Explicit machine computation and programs (not the theory of computation or programming)
- 58-06 Collections of papers; proceedings of conferences

(Bednarek, A. R.) See *Dynamical systems*, (55 #12979)

(Burlat, O.) See *Singularités d'applications différentiables*, 55 #11287

(do Carmo, Manfredo Perdigão) See *Geometry and topology*, (56 #11)

(Cesari, Lamberto) See *Dynamical systems*, (55 #12979)

(Dolcher, M.) See *Global analysis and its applications*, 55 #9129a; *Global analysis and its applications*, 55 #9129b and *Global analysis and its applications*, 55 #9129c

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## 60G50 Sums of independent random variables

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- Pasedach, K. Einsatz blockzirkulanter Matrizen zur Rekonstruktion einer Funktion aus ihren Linienintegralen. (56 #9904)
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## 68-XX COMPUTER SCIENCE [For papers involving machine computations and programs in a specific mathematical area, see section -04 in that area.]

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## 68-01 Elementary exposition (collegiate level)

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- Hennie, Fred ★Introduction to computability. (56 #11767)
- Holland, John H. ★Adaptation in natural and artificial systems. (55 #14256)
- Jušenko, K. L. See Gluškov, V. M.; et al., 55 #13847
- Knuth, Donald E. The dangers of computer-science theory. 56 #17174
- The computer as master mind. (55 #7645)
- Krinickii, N. A. (with Mironov, G. A.; Frolov, G. D.) ★Программирование и алгоритмические языки. (Russian) [Programming, and algorithmic languages] 55 #13848
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- (Bloom, Howard M.) See High-level language computer architecture, 55 #11662
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- Book, Ronald V. Formal language theory and theoretical computer science. 55 #1765
- (Carlson, Carl R.) See High-level language computer architecture, 55 #11662
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- (De Remer, F. L.) See Compiler construction, 56 #1763
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- (Gries, David) See Compiler construction, 56 #1763
- (Griffiths, M.) See Compiler construction, 56 #1763
- Heidorn, G. E. Automatic programming through natural language dialogue: a survey. 55 #1766
- (Hill, U.) See Compiler construction, 56 #1763
- (Horning, J. J.) See Compiler construction, 56 #1763
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## 68-03 Historical

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85.58 Global analysis, analysis on manifolds

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- 86-04 Explicit machine computation and programming (not the theory of computation or programming)
- 86-06 Collections of papers; proceedings of conferences
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- 86.02 Logic and foundations
- 86.04 Set theory
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- 86.45 Integral equations
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- Finite elements in geomechanics** ★Finite elements in geomechanics. 56 #4715
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- Bazaraa, Mokhtar S. (with Jarvis, John J.) ★Linear programming and network flows. (56 #2346)
- Belen'kii, V. Z. (with Volkonskii, V. A.; Ivankov, S. A.; Pomanskii, A. B.; Šapiro, A. D.) ★Итеративные методы в теории игр и программирования. (Russian) [Iterative methods in game theory and programming] 56 #2192
- Bensoussan, Alain (with Hurst, E. Gerald, Jr.; Näslund, B.) ★Management applications of modern control theory. 56 #10751
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- Dorninger, D. (with Nöbauer, W.; Timischl, W.) ★Lineare Optimierung und Anwendungen. (55 #9941)
- Duru, Gérard See Auray, Jean Paul; et al., 56 #14549
- Faure, Robert (with Roucairol, Catherine; Tolla, Pierre) ★Chemins et flots, ordonnancements. 56 #7765
- Ghosal, A. (with Loo, S. G.; Singh, Niranjana) ★Examples & exercises in operations research. (55 #14155)
- Ghosh, Malay (with Meeden, Glen) On the non-attainability of Chebyshev bounds. 56 #3908
- Govar, V. M. ★Математическое программирование. (Russian) [Mathematical programming] 55 #2058
- Grossmann, Christian (with Kleinmichel, Helmut) ★Verfahren der nichtlinearen Optimierung. (55 #12101)
- Gupta, Jatinder N. D. See Ignizio, James P., 56 #4716
- Haberman, Richard ★Mathematical models. 55 #14066
- Holland, John H. ★Adaptation in natural and artificial systems. (55 #14256)
- Hurst, E. Gerald, Jr. See Bensoussan, Alain; et al., 56 #10751
- Ignizio, James P. (with Gupta, Jatinder N. D.) ★Operations research in decision making. 56 #4716
- Ivankov, S. A. See Belen'kii, V. Z.; et al., 56 #2192
- Jaeger, Arno (with Wenke, Klaus) ★Lineare Wirtschafts algebra. (55 #12744)
- Jarvis, John J. See Bazaraa, Mokhtar S., (56 #2346)
- Kall, Peter ★Mathematische Methoden des Operations Research. 55 #11920
- Kemeny, John G. (with Snell, J. Laurie; Thompson, Gerald L.) ★Einführung in die endliche Mathematik. (55 #7644)
- Kleinmichel, Helmut See Grossmann, Christian, (55 #12101)
- (Kotz, Samuel) See Vorob'ev, Nikolai Nikolaevič, 56 #10752
- Krekó, Béla ★Optimierung—nichtlineare Modelle. 55 #11921
- Lauber, Josef See Walter, Jaromir, 55 #11923
- Lawler, Eugene L. Combinatorial optimization: networks and matroids. (55 #12005)
- (Leach, James) See Science, decision and value, (56 #2195)
- (Lipovsky, Ferdinand) See Kemeny, John G.; et al., (55 #7644)
- Loo, S. G. See Ghosal, A.; et al., (55 #14155)
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- Pun, Lucas (with Aracil, Javier; Abatut, Jean-Louis) ★Integrated automation practice. 56 #4717
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# 1980

# MATHEMATICS

# SUBJECT

# CLASSIFICATION

Compiled in the Editorial Offices of MATHEMATICAL REVIEWS and ZENTRALBLATT FÜR MATHEMATIK

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\* For a listing of the subject classification used in Mathematical Reviews from 1973–1979 see the index to Volume 54 (December 1977) or Volumes 46–52.



## 1980 Mathematical Subject Classification

The 1980 Mathematics Subject Classification is a modest revision of the AMS (MOS) Subject Classification Scheme (1970). The revision was carried out jointly by Mathematical Reviews and Zentralblatt für Mathematik/Mathematics Abstracts. Mathematical Reviews will begin to use it in the first 1979 issue of CMP and in the January 1980 issue of MR. The new classification maintains the general structure of, and can be used in the same way as, the earlier one. The major changes in the classification system are summarized below. It is strongly recommended that anyone using this system for any reason read the instructions for its use and peruse the whole system.

The sections 02 and 50 have been completely rewritten and are now labeled “03 Logic and foundations” and “51 Geometry”, respectively. The following major fields were each rearranged (and in some cases expanded) and divided into several letter sections:

|  |  |
|--|--|
| 06 Order, lattices, ordered algebraic structures | 39 Finite differences and functional equations |
| 08 General mathematical systems                  | 42 Fourier analysis                            |
| 26 Real functions                                | 68 Computer science (including automata)       |
| 28 Measure and integration                       | 81 Quantum mechanics                           |
| 30 Functions of a complex variable               | 94 Information and communication, circuits     |

In many fields, the contents of the letter sections have been considerably expanded and/or rewritten. In particular, this is the case in the following sections: 10 Number theory; 12 Algebraic number theory, field theory and polynomials; 14 Algebraic geometry; 32 Several complex variables and analytic spaces; 58 Global analysis, analysis on manifolds. Section 18H has been deleted, and “Cohomology of X” is now found in the appropriate field for X. The contents of the old “20E Infinite groups” and “20F General groups, finite or infinite” were reshuffled and rewritten; the new section headings are “20E Structure and classification of infinite or finite groups” and “20F Special aspects of infinite or finite groups”. Section 34J has been deleted; in its place one should use section “34K Functional-differential and differential-difference equations, with or without deviating (or retarded) arguments”. There has been some reshuffling of the contents of 46L and 47D; 46L now contains only  $C^*$ - and von Neumann algebras and their applications, while general operator algebras and related topics are in section “47D Algebraic systems of linear operators”. The items in “49A Existence theory for optimal solutions” and “49B Necessary conditions and sufficient conditions for optimality” have been re-numbered so that the fine classifications are parallel now. The letter sections in “55 Algebraic topology” and “57 Manifolds and cell complexes” were re-ordered and the old 55A moved to 57; to avoid confusion between the old and the new classification, each of 55 and 57 now begins with a letter section M: 55C becomes 55M, 55B becomes 55N, 55A becomes 55M, 57A becomes 57N, and the remaining sections in 55 and 57 follow in the previous order.

Automata have been moved from Section 94 to Section 68. Any paper or book with its primary classification in (i.e., printed in) a physics section (70 through 86) must be assigned a cross-reference to at least one mathematics section (00 through 65). Papers in physics which are difficult to classify mathematically may be given the cross-reference 00A89. The section “69.00 General applied mathematics” (used in MR through 1979) has been moved to 00A69.

### Instructions for using the 1980 Mathematics Subject Classification

These instructions apply uniformly to all fields listed. The main purpose of the classification is to help all readers to find the items of present or potential interest to them as readily as possible—in MR, in Zbl, or anywhere else where this classification system is used. The review of a paper or book should be printed in the section where it will receive the broadest attention from all readers possibly interested in it—these include both people working in that area and people who are familiar with that area and apply its results and methods elsewhere (inside or outside of mathematics). It will be extremely useful for both readers and classifiers to familiarize themselves with the entire classification system and thus to become aware of all the classifications of possible interest to them.

Every paper or book reviewed in MR receives precisely one “primary” classification number; it is simply the number of the section in which the review of the item will be printed. This section should be the one that covers the principal contribution. When a paper contains several principal contributions in different areas, the primary classification should cover the “most important” among them. A paper or book may receive one or several “secondary” classification numbers (or “cross-references”), to cover any remaining principal contributions, ancillary results, motivation or origin of the problems discussed, intended or potential field of application, or other significant aspects worthy of notice.

The “primary” principal contribution should be the one including the most important part of the work actually done in the paper. For example, a paper whose main overall content is the solution of a problem in graph theory, which arose in computer science and whose solution is (perhaps) at present only of interest to computer scientists, should receive its primary classification in 05C and a cross-reference in 68; conversely, papers whose overall content lies mainly in computer science will receive a primary classification in 68, even if they make heavy use of graph theory and prove several new graph theoretic results along the way.

Any paper or book with its primary classification in (i.e., printed in) a physics section (70 through 86) must be assigned a cross-reference to at least one mathematics section (00 through 65). Papers in physics for which no other mathematical classification is suitable may be given the cross-reference 00A89.

There are two types of cross-references given after many classifications in the list. The first type is of the form “[For A, see X]”; if this appears in section Y, it means that for contributions described by A one should usually assign the classification X, not Y. The other type of cross-reference merely points out related classifications; it is of the form “[See also . . .]”, “[See mainly . . .]”, etc., and the classifications listed in the brackets may, but need not, be added to the classification of a paper, or they may be used in place of the classification where the cross-reference is given. The classifier will have to judge which classification is the most appropriate for the paper at hand.



**00-XX GENERAL**

- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
- 01 Elementary exposition, textbooks
- 02 Advanced exposition (research surveys, monographs, etc.)
- A05 General mathematics
- A06 Mathematics for non-mathematicians (engineering, social sciences, etc.)
- A07 Problem books
- A10 Collections of papers; proceedings of conferences of general interest, translation volumes, etc. [See also 01A75.]
- A15 General bibliographies
- A20 Dictionaries and other general reference works
- A22 Formularies
- A25 Methodology and philosophy of mathematics
- A69 General applied mathematics (For cross reference to reviews printed in Sections 70 through 86, use 00A89.)
- A89 Physics (to be used in cross references to reviews printed in Sections 70 through 86, only when no other numbers from Sections 00 through 65 are suitable)
- A99 Miscellaneous topics

**01-XX HISTORY AND BIOGRAPHY [See also the classification number -03 in the other sections.]**

- 06 Proceedings, conferences, etc.
- A05 General histories, source books
- A10 Primitive, Paleolithic, Neolithic
- A15 Pre-Greek, Egyptian
- A17 Babylonian
- A20 Greek
- A25 China
- A27 Japan
- A29 Southeast Asia
- A30 Islam (Medieval)
- A32 India
- A35 Medieval
- A40 15th and 16th centuries, Renaissance
- A45 17th century
- A50 18th century
- A55 19th century
- A60 20th century
- A65 Contemporary
- A70 Biographies, obituaries, personalia
- A72 Schools of mathematics
- A73 Universities
- A74 Other institutions and academies
- A75 Collected or selected works; reprintings or translations of classics
- A80 Sociology (and profession) of mathematics
- A99 Miscellaneous topics

**03-XX MATHEMATICAL LOGIC AND FOUNDATIONS**

- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
- 01 Elementary exposition, textbooks
- 02 Advanced exposition (research surveys, monographs, etc.)
- 03 Historical (must also be assigned at least one classification number from Section 01)
- 04 Explicit machine computation and programs (not the theory of computation or programming)
- 06 Proceedings, conferences, etc.

**03A05 Philosophical and critical****03Bxx General logic**

- B05 Classical propositional logic
- B10 Pure first-order logic (including many-sorted logic)
- B15 Higher-order logic and type-theory
- B20 Fragments of classical logic
- B25 Decidability of theories and sets of sentences
- B30 Foundations of classical theories
- B35 Mechanical theorem proving

- B40 Combinatory logic and  $\lambda$ -calculus
- B45 Modal and tense logic, entailment, etc.
- B50 Many-valued logic
- B52 Fuzzy logic [See also 94D05.]
- B55 Intermediate logics
- B60 Other non-classical logic
- B99 None of the above, but in this section

**03Cxx Model theory**

- C05 Equational classes, universal algebra [See also 08Axx.]
- C10 Quantifier elimination and related topics
- C15 Countable models
- C20 Ultraproducts and related constructions
- C25 Model-theoretic forcing
- C30 Other model constructions
- C35 Categoricity and completeness
- C40 Preservation, interpolation, and definability theorems
- C45 Stability
- C50 Models with special properties (saturated, rigid, etc.)
- C52 Properties of classes of models
- C55 Set-theoretic model theory
- C60 Model-theoretic algebra [See also 08C10.]
- C65 Models of specific theories
- C70 Logic on admissible sets
- C75 Other infinitary logic
- C80 Logic with extra quantifiers and operators
- C85 Second- and higher-order model theory
- C90 Non-classical models (Boolean-valued, sheaf, etc.)
- C95 Abstract model theory
- C99 None of the above, but in this section

**03Dxx Recursion theory**

- D03 Thue and Post systems, etc.
- D05 Automata and formal grammars in connection with logical questions [See also 18B20, 68Dxx, 68F10.]
- D10 Turing machines and related notions [See also 68C40.]
- D15 Complexity of computation
- D20 Recursive functions and relations, subrecursive hierarchies
- D25 Recursively enumerable sets and degrees
- D30 Degrees and reducibilities
- D35 Undecidability and degrees of sets of sentences
- D40 Word problems, etc. [See also 06B25, 08A50, 20F10.]
- D45 Theory of numerations, effectively presented structures
- D50 Recursive equivalence types of sets and structures, isols
- D55 Hierarchies
- D60 Recursion theory on ordinals, admissible sets, etc.
- D65 Higher-type recursion theory
- D70 Inductive definability
- D75 Abstract and axiomatic recursion theory
- D80 Applications
- D99 None of the above, but in this section

**03Exx Set theory [See also 04-XX.]**

- E05 Combinatorial set theory
- E10 Ordinal and cardinal arithmetic
- E15 Descriptive set theory
- E20 Other classical set theory
- E25 Axiom of choice and related propositions
- E30 Axiomatics of classical set theory and its fragments
- E35 Consistency and independence results
- E40 Other aspects of forcing and Boolean-valued models
- E45 Constructibility, ordinal definability, and related notions
- E50 Continuum hypothesis and Martin's axiom [See also 54A25.]
- E55 Large cardinals
- E60 Axiom of determinacy and other axioms which contradict the axiom of choice
- E65 Other hypotheses and axioms
- E70 Non-classical and second-order set theories
- E72 Fuzzy sets [See also 54A40, 94D05.]
- E75 Applications
- E99 None of the above, but in this section



**03Fxx Proof theory and constructive mathematics**

- F05 Cut-elimination and normal-form theorems
- F10 Functionals in proof theory
- F15 Recursive ordinals and ordinal notations
- F20 Complexity of proofs
- F25 Relative consistency and interpretations
- F30 First-order arithmetic and fragments
- F35 Second- and higher-order arithmetic and fragments [See also 03E30, 03E70.]
- F50 Metamathematics of constructive systems
- F55 Intuitionistic mathematics
- F60 Recursive analysis
- F65 Other constructive mathematics
- F99 None of the above, but in this section

**03Gxx Algebraic logic**

- G05 Boolean algebras [See also 06Exx.]
- G10 Lattices and related structures [See also 06Bxx.]
- G12 Quantum logic [See also 81B10.]
- G15 Cylindric and polyadic algebras
- G20 Łukasiewicz and Post algebras
- G25 Other algebras related to logic
- G30 Categorical logic, topoi [See also 18B25.]
- G99 None of the above, but in this section

**03Hxx Non-standard models**

- H05 Infinitesimal analysis in pure mathematics [See also 26E35, 30G10, 54J05.]
- H10 Other applications of infinitesimal analysis
- H15 Non-standard models of arithmetic [See also 10N15, 12L15, 13L15.]
- H20 Other non-standard models [See also 54J05.]
- H99 None of the above, but in this section

**04-XX SET THEORY**

- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
- 01 Elementary exposition, textbooks
- 02 Advanced exposition (research surveys, monographs, etc.)
- 03 Historical (must also be assigned at least one classification number from Section 01)
- 04 Explicit machine computation and programs (not the theory of computation or programming)
- 06 Proceedings, conferences, etc.
- A05 Relations, functions [See also 08A05.]
- A10 Transfinite numbers
- A15 Descriptive set theory; Borel classifications, Suslin schemes, etc. [See also 03E15, 28A05, 54H05.]
- A20 Combinatorial [See also 05A05.]
- A25 Axiom of choice and equivalent propositions (Zorn's lemma, etc.) [See also 03E25.]
- A30 Continuum hypothesis, generalized continuum hypothesis [See also 03E50, 54A25.]
- A99 Miscellaneous topics

**05-XX COMBINATORICS {For finite fields, see 12Cxx.}**

- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
- 01 Elementary exposition, textbooks
- 02 Advanced exposition (research surveys, monographs, etc.)
- 03 Historical (must also be assigned at least one classification number from Section 01)
- 04 Explicit machine computation and programs (not the theory of computation or programming)
- 06 Proceedings, conferences, etc.

**05Axx Classical combinatorial problems**

- A05 Combinatorial choice problems (subsets, representatives, permutations)
- A10 Factorials, binomial coefficients, combinatorial functions
- A15 Combinatorial enumeration problems, generating functions
- A17 Partitions [See also 10A45.]
- A19 Combinatorial identities
- A20 Combinatorial inequalities
- A99 None of the above, but in this section

**05Bxx Designs and configurations {For applications of design theory, see 94C30.}**

- B05 Block designs [See also 51E05, 62K10.]
- B10 Difference sets (number-theoretic, group-theoretic, etc.) [See also 10L05.]
- B15 Orthogonal arrays, Latin squares, Room squares
- B20 Matrices (incidence, Hadamard, etc.)
- B25 Finite geometries [See also 51D20, 51Exx.]
- B30 Other designs, configurations [See also 51E30.]
- B35 Matroids, geometric lattices
- B40 Packing and covering [See also 10E30, 52A45.]
- B45 Tessellation and tiling problems
- B50 Polyominoes
- B99 None of the above, but in this section

**05Cxx Graph theory {For applications of graphs, see 68D90, 68E10, 94C15.}**

- C05 Trees
- C10 Topological graph theory, imbedding [See also 57M15, 57M25.]
- C15 Chromatic theory of graphs and maps
- C20 Directed graphs (digraphs)
- C25 Graphs and groups [See also 20F32.]
- C30 Enumeration of graphs and maps
- C35 Extremal problems
- C38 Paths and cycles
- C40 Connectivity
- C45 Eulerian and Hamiltonian graphs
- C50 Graphs and matrices
- C55 Generalized Ramsey theory
- C60 Reconstruction conjecture
- C65 Hypergraphs
- C99 None of the above, but in this section

**06-XX ORDER, LATTICES, ORDERED ALGEBRAIC STRUCTURES [See also 18B35.]**

- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
- 01 Elementary exposition, textbooks
- 02 Advanced exposition (research surveys, monographs, etc.)
- 03 Historical (must also be assigned at least one classification number from Section 01)
- 04 Explicit machine computation and programs (not the theory of computation or programming)
- 06 Proceedings, conferences, etc.

**06Axx Ordered sets**

- A05 Total order
- A10 Partial order
- A12 Semilattices [See also 20M10.]
- A15 Galois correspondences, closure operators
- A23 Complete lattices, completions
- A99 None of the above, but in this section

**06Bxx Lattices [See also 03G10.]**

- B05 Structure theory
- B10 Ideals, congruence relations
- B15 Representation theory
- B20 Varieties of lattices
- B25 Free lattices, projective lattices, word problems [See also 03D40, 08A50, 20F10.]
- B30 Topological lattices, order topologies [See also 06F30, 54F05, 54H12.]
- B99 None of the above, but in this section

**06Cxx Modular lattices, complemented lattices**

- C05 Modular lattices, Desarguesian lattices
- C10 Semimodular lattices, geometric lattices
- C15 Complemented lattices, orthocomplemented lattices
- C20 Complemented modular lattices, continuous geometries
- C99 None of the above, but in this section

**06Dxx Distributive lattices**

- D05 Structure and representation theory
- D10 Complete distributivity
- D15 Pseudocomplemented lattices



- D20 Heyting algebras [See also 03Gxx.]  
 D25 Post algebras [See also 03G20.]  
 D30 DeMorgan algebras, Łukasiewicz algebras [See also 03G20.]  
 D99 None of the above, but in this section
- 06Exx Boolean algebras [See also 03G05.]**  
 E05 Structure theory  
 E10 Chain conditions, complete algebras  
 E15 Topological representation  
 E20 Boolean rings [See also 16A30, 16A32.]  
 E99 None of the above, but in this section
- 06Fxx Ordered structures [See also 22A26, 54F05.]**  
 F05 Ordered semigroups [See also 20Mxx.]  
 F10 Noether lattices  
 F15 Ordered groups [See also 20F60.]  
 F20 Ordered abelian groups, ordered linear spaces [See also 46A40.]  
 F25 Ordered rings, algebras, modules {For ordered fields, see 10M15, 12J15; see also 13J25, 16A86.}  
 F30 Topological lattices, order topologies [See also 06B30, 54F05, 54H12.]  
 F99 None of the above, but in this section
- 08-XX GENERAL MATHEMATICAL SYSTEMS**  
 -00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)  
 -01 Elementary exposition, textbooks  
 -02 Advanced exposition (research surveys, monographs, etc.)  
 -03 Historical (must also be assigned at least one classification number from Section 01)  
 -04 Explicit machine computation and programs (not the theory of computation or programming)  
 -06 Proceedings, conferences, etc.
- 08Axx Universal algebra [See also 03C05.]**  
 A05 Structure theory  
 A30 Subalgebras, congruence relations  
 A35 Automorphisms, endomorphisms  
 A40 Operations, polynomials, primal algebras  
 A45 Equational compactness  
 A50 Word problems [See also 03D40, 20F10.]  
 A55 Partial algebras  
 A60 Unary algebras  
 A65 Infinitary algebras  
 A99 None of the above, but in this section
- 08Bxx Varieties**  
 B05 Equational logic, Mal'cev conditions  
 B10 Congruence modularity, congruence distributivity  
 B15 Lattices of varieties  
 B20 Free algebras  
 B25 Products, amalgamated products  
 B30 Injectives, projectives  
 B99 None of the above, but in this section
- 08Cxx Classes of algebras**  
 C05 Categories of algebras [See also 18C05.]  
 C10 Axiomatic model classes [See also 03Cxx, in particular 03C60.]  
 C15 Quasivarieties  
 C99 None of the above, but in this section
- 10-XX NUMBER THEORY {Excluding 10Axx and 10Mxx, this classification scheme does not distinguish work in the rational number fields from that in other algebraic number fields.}**  
 -00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)  
 -01 Elementary exposition, textbooks  
 -02 Advanced exposition (research surveys, monographs, etc.)  
 -03 Historical (must also be assigned at least one classification number from Section 01)  
 -04 Explicit machine computation and programs (not the theory of computation or programming)  
 -06 Proceedings, conferences, etc.
- 10Axx Elementary number theory {For analogues in number fields, see 12A05.}**  
 A05 Multiplicative structure of the integers (GCD, etc.)  
 A10 Congruences, primitive roots  
 A15 Power residues, reciprocity  
 A20 Number-theoretic functions, related numbers; inversion formulas  
 A21 Counting functions  
 A22 Abstract theory of number-theoretic functions  
 A25 Elementary prime number theory, factorization  
 A30 Algorithms and expansions; digital properties {For metric results, see 10K10.}  
 A32 Continued fractions {For approximation results, see 10F20; see also 30B70, 40A15.}  
 A35 Recurrence sequences  
 A40 Special numbers, sequences and polynomials (e.g. Bernoulli)  
 A45 Partitions  
 A99 None of the above, but in this section
- 10Bxx Diophantine equations [See also 14Gxx.]**  
 B05 Linear, quadratic and bilinear equations  
 B10 Cubic and quartic equations  
 B15 Higher degree equations  
 B16 Norm form equations  
 B20 Multiplicative equations  
 B25 Nonpolynomial equations  
 B30 Equations in sufficiently many variables [See also 10J10.]  
 B35 Representation problems [See also 10J10.]  
 B40  $p$ -adic and power series fields  
 B45 Diophantine inequalities  
 B99 None of the above, but in this section
- 10Cxx Forms (especially quadratic) {For quadratic forms in linear algebra, see 15A63.}**  
 C01 Forms over general fields (especially quadratic)  
 C02 Forms over global rings and fields (especially quadratic)  
 C03 Forms over local rings and fields (especially quadratic)  
 C04 Forms over real fields  
 C05 Quadratic, bilinear and Hermitian forms [See also 10E25.], general theory {For Witt rings, see 13K05.}  
 C07 Class numbers of quadratic and Hermitian forms  
 C10 Higher degree forms  
 C15 Analytic theory (Epstein's zeta-function; relations with automorphic forms and functions)  
 C20  $p$ -adic theory  
 C25 Minima of forms [See also 10E20.]  
 C30 Arithmetic properties of classical groups [See also 20Gxx.]  
 C99 None of the above, but in this section
- 10Dxx Theory of automorphic and modular functions and forms [See also 12A67, 12B27, 14Gxx, 14Kxx, 22E50, 22E55, 30F35, 32Nxx; for relations with quadratic forms, see 10C15.]**  
 D05 Modular and automorphic functions  
 D07 Structure of modular groups and generalizations, arithmetic groups [See also 20H05, 20H10, 22E40.]  
 D12 Modular forms, one variable  
 D15 Automorphic forms, one variable  
 D20 Modular and automorphic forms, several variables  
 D21 Hilbert modular forms and surfaces [See also 14J20.]  
 D23 Congruence properties  
 D24 Relations with Dirichlet series  
 D25 Complex multiplication [See also 14K22.]  
 D30  $p$ -adic theory, local fields [See also 14G20, 22E50.]  
 D35 Galois properties  
 D40 Representation-theoretic methods, trace formulas  
 D45 Uniformization, periods and cohomology  
 D99 None of the above, but in this section
- 10Exx Geometry of numbers**  
 E05 Lattices and convex bodies [See also 10J25.]  
 E10 Nonconvex bodies  
 E15 Products of linear forms  
 E20 Minima of forms [See also 10C25.]



- E25 Quadratic forms (reduction, extreme forms, etc.) [See also 10C05.]
- E30 Lattice packing and covering [See also 05B40, 52A45.]
- E35 Mean value theorems
- E40 Transfer theorems
- E45 Automorphism groups of lattices [See also 10C30.]
- E99 None of the above, but in this section
- 10Fxx Diophantine approximation [See also 10K15.]**
  - F05 Approximation to one number
  - F10 Simultaneous approximation
  - F15 Nonhomogeneous approximation
  - F20 Continued fractions and generalizations [See also 10A32, 10K10.]
  - F25 Approximation to algebraic numbers
  - F30 Approximation by numbers from a fixed field
  - F35 Irrationality and transcendence
  - F37 Independence results
  - F40 Distribution modulo one [See also 10K05.]
  - F45 Approximation in non-Archimedean valuations
  - F99 None of the above, but in this section
- 10Gxx Trigonometric sums, exponential sums and character sums**
  - G05 Exponential sums
  - G10 Estimates on exponential sums
  - G15 Character sums
  - G20 Estimates on character sums
  - G99 None of the above, but in this section
- 10Hxx Multiplicative theory**
  - H05 Riemann's zeta-function, functional equation
  - H08 Dirichlet  $L$ -function, functional equation
  - H10 Other zeta-functions {For local and global ground fields, see 12A70, 12A80, 12B30, 12B35; for algebro-geometric methods, see 14G10; see also 10C15, 10D40.}
  - H15 Distribution of primes and of integers with specified multiplicative properties
  - H20 Distribution in progressions and other sequences [See also 10L20.]
  - H22 Turán theory
  - H25 Asymptotic results on arithmetic functions
  - H26 Asymptotic results on counting functions for algebraic and topological structures
  - H30 Sieves, upper and lower estimates
  - H32 Applications of sieve methods
  - H35 Distribution of residue classes (primitive roots, power residues, etc.)
  - H40 Generalized primes and integers
  - H45 Almost-periodic number-theoretic functions [See also 10K35.]
  - H99 None of the above, but in this section
- 10Jxx Additive theory**
  - J05 Sums of squares
  - J06 Sums of higher powers
  - J10 Applications of Hardy-Littlewood method [See also 10B35.]
  - J15 Additive questions involving primes
  - J20 Analytic work on partitions [See also 10A45.]
  - J25 Lattice points in large regions
  - J99 None of the above, but in this section
- 10Kxx Probabilistic theory; measure, dimension, etc.**
  - K05 Distribution modulo one [See also 10F40.]
  - K10 Algorithms and expansions [See also 10A30, 10F20.]
  - K15 Diophantine approximation [See also 10Fxx.]
  - K20 Arithmetic functions
  - K25 Normal numbers
  - K30 Irregularities of distribution
  - K35 Harmonic analysis and almost periodicity [See also 10H45.]
  - K40 Non-Archimedean theory
  - K99 None of the above, but in this section
- 10Lxx Sequences of integers**
  - L02 Density of sum sets, analogues and generalizations
  - L05 Addition of sequences, additive bases [See also 05B10.]
- L10 Special sequences (density, multiplicative, additive and other properties)
- L15 Representation functions
- L20 Arithmetic progressions [See also 10H20.]
- L99 None of the above, but in this section
- 10Mxx Rational arithmetic of algebraic objects**
  - M05 Polynomials [See also 13F20.]
  - M10 Valued fields [See also 12J10.]
  - M15 Ordered fields [See also 12J15.]
  - M20 Matrices [See also 15A36.]
  - M99 None of the above, but in this section
- 10Nxx Connections with logic**
  - N05 Decidability [See also 03B25.]
  - N10 Ultraproducts [See also 03C20.]
  - N15 Nonstandard arithmetic [See also 03H15.]
  - N99 None of the above, but in this section
- 12-XX ALGEBRAIC NUMBER THEORY, FIELD THEORY AND POLYNOMIALS**
  - 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
  - 01 Elementary exposition, textbooks
  - 02 Advanced exposition (research surveys, monographs, etc.)
  - 03 Historical (must also be assigned at least one classification number from Section 01)
  - 04 Explicit machine computation and programs (not the theory of computation or programming)
  - 06 Proceedings, conferences, etc.
  - 12Axx Algebraic number theory: global fields {For complex multiplication, see 10D25.}**
    - A05 Analogues in number fields of elementary number theory
    - A10 Characterizations of algebraic numbers and algebraic functions
    - A15 Special algebraic numbers (PV numbers, etc.)
    - A20 Polynomials (irreducibility, etc.)
    - A25 Quadratic fields
    - A30 Cubic and quartic fields
    - A35 Abelian and metabelian extensions (including cyclotomic, Kummer, cyclic)
    - A40 Other number fields
    - A45 Units and factorization
    - A50 Class number, discriminant
    - A55 Galois theory
    - A57 Integral representations related to algebraic numbers [See also 20C10.]
    - A60 Galois cohomology [See also 12Gxx, 16A16.]
    - A62 Applications of algebraic  $K$ -theory
    - A65 Class field theory
    - A67 Langlands-Weil conjectures, nonabelian class field theory [See also 10Dxx, 22E55.]
    - A70 Zeta-functions of number fields and generalizations [See also 10H08, 10H10.]
    - A75 Density theorems
    - A80 Arithmetic of algebras [See also 12B35, 16A18, 16A39.]
    - A82 Zeta-functions of algebras
    - A85 Analysis in adèle rings and groups
    - A90 Arithmetic theory of algebraic function fields [See also 14-XX.]
    - A95 Totally real and totally positive fields
    - A99 None of the above, but in this section
  - 12Bxx Algebraic number theory: local and  $p$ -adic fields**
    - B05 Polynomials
    - B10 Ramification and extension theory
    - B15 Galois theory
    - B17 Integral representations
    - B20 Galois cohomology [See also 12Gxx, 16A16.]
    - B22 Applications of algebraic  $K$ -theory
    - B25 Class field theory
    - B27 Langlands-Weil conjectures, nonabelian class field theory [See also 10Dxx, 22E50.]
    - B30 Zeta- and  $L$ -functions [See also 10H08, 10H10.]
    - B35 Arithmetic of algebras [See also 12A80, 16A18, 16A39.]
    - B37 Zeta-functions of algebras



- B40 Other analytic theory  
 B45 Other nonanalytic theory  
 B99 None of the above, but in this section  
**12Cxx Finite fields, and finite commutative rings (number-theoretic aspects)**  
 C05 Polynomials  
 C10 Linear sequences  
 C15 Arithmetic  
 C20 Cyclotomy  
 C25 Exponential sums  
 C30 Structure theory  
 C99 None of the above, but in this section  
**12Dxx Real and complex fields**  
 D05 Polynomials: factorization  
 D10 Polynomials: location of zeros (algebraic theorems) {For the analytic theory, see 26C10, 30C15.}  
 D15 Formally real fields  
 D99 None of the above, but in this section  
**12Exx General field theory**  
 E05 Polynomials (irreducibility, etc.)  
 E10 Special polynomials  
 E12 Equations  
 E15 Skew fields, division rings [See also 12A80, 12B35, 16A39.]  
 E99 None of the above, but in this section  
**12Fxx Field extensions**  
 F05 Algebraic extensions  
 F10 Separable extensions, Galois theory  
 F15 Inseparable extensions, derivations  
 F20 Transcendental extensions  
 F99 None of the above, but in this section  
**12Gxx Homological methods**  
 G05 Galois cohomology [See also 12A60, 12B20, 13A20, 16A16.]  
 G10 Cohomological dimension  
 G99 None of the above, but in this section  
**12Hxx Differential and difference algebra**  
 H05 Differential algebra [See also 13N05.]  
 H10 Difference algebra [See also 39Axx.]  
 H20 Abstract differential equations [See also 34G05.]  
 H25  $p$ -adic differential equations [See also 12B40, 14G20, 34G05.]  
 H99 None of the above, but in this section  
**12Jxx Topological fields**  
 J05 Normed fields  
 J10 Valued fields [See also 10M10.]  
 J15 Ordered fields [See also 10M15.]  
 J17 Topological semi-fields  
 J20 General valuation theory  
 J25 Non-Archimedean valued fields [See also 26E30, 30G05, 32D25, 46P05.]  
 J27 Krasner-Tate algebras [See mainly 32E27, also 46P05.]  
 J99 None of the above, but in this section  
**12Kxx Generalizations**  
 K05 Near-fields [See also 16A76.]  
 K10 Semi-fields [See also 16A78.]  
 K99 None of the above, but in this section  
**12Lxx Connections with logic**  
 L05 Decidability  
 L10 Ultraproducts  
 L15 Nonstandard arithmetic [See also 03H15.]  
 L99 None of the above, but in this section  
**13-XX COMMUTATIVE RINGS AND ALGEBRAS {For the noncommutative case, see 16-XX.}**  
 -00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)  
 -01 Elementary exposition, textbooks  
 -02 Advanced exposition (research surveys, monographs, etc.)  
 -03 Historical (must also be assigned at least one classification number from Section 01)  
 -04 Explicit machine computation and programs (not the theory of computation or programming)  
 -06 Proceedings, conferences, etc.
- 13Axx General commutative ring theory**  
 A05 Divisibility  
 A10 Radical theory  
 A15 Ideals  
 A17 Prime and primary ideals and their generalizations  
 A18 Valuations and their generalizations  
 A20 Brauer groups [See also 12Gxx, 16A16.]  
 A99 None of the above, but in this section  
**13Bxx Ring extensions and related topics**  
 B02 Extension theory  
 B05 Galois theory  
 B10 Automorphisms and derivations  
 B15 Ramification theory  
 B20 Integral dependence; integral closure; integrally closed rings, related rings (Japanese, etc.)  
 B25 Polynomials over commutative rings  
 B30 Quotients and localization  
 B99 None of the above, but in this section  
**13Cxx Theory of modules and ideals**  
 C05 Structure, classification theorems  
 C10 Projective and free modules and ideals [See also 18G05.]  
 C11 Injective and flat modules and ideals [See also 18G05.]  
 C12 Torsion modules and ideals  
 C13 Other special types  
 C15 Dimension theory, depth, related rings (catenary, etc.)  
 C99 None of the above, but in this section  
**13Dxx Homological methods**  
 D03 Cohomology of commutative rings and algebras  
 D05 Homological dimension  
 D10 Deformations and infinitesimal methods [See also 14D15, 16A58, 32Gxx.]  
 D15 Grothendieck group,  $K$ -theory [See also 14F15, 18F25, 18F30.]  
 D25 Complexes [See also 14Mxx.]  
 D30 Torsion theory [See also 13C12, 16A63, 18E40.]  
 D99 None of the above, but in this section  
**13Exx Chain conditions, finiteness conditions**  
 E05 Noetherian rings and modules  
 E10 Artinian rings and modules, finite-dimensional algebras  
 E15 Rings and modules of finite generation or representation  
 E99 None of the above, but in this section  
**13Fxx Arithmetic rings [See also 12-XX.]**  
 F05 Dedekind and Prüfer rings and their generalizations  
 F07 Euclidean rings and generalizations  
 F10 Principal ideal rings  
 F15 Factorial rings, unique factorization domains  
 F20 Polynomial rings [See also 10M05.]  
 F25 Formal power series rings  
 F30 Discrete valuation rings  
 F99 None of the above, but in this section  
**13G05 Integral domains**  
**13Hxx Local rings and semilocal rings**  
 H05 Regular local rings  
 H10 Special types (Macaulay, Gorenstein, etc.)  
 H15 Multiplicity theory and related topics  
 H99 None of the above, but in this section  
**13Jxx Topological rings [See also 16A80.]**  
 J05 Power series rings  
 J10 Complete rings  
 J15 Henselian rings  
 J20 Global topological rings  
 J25 Ordered rings [See also 06F25, 16A86.]  
 J99 None of the above, but in this section  
**13K05 Witt vectors and related rings [See also 10Cxx.]**  
**13L05 Applications of logic to commutative algebra [See also 03Cxx, 03Hxx.]**  
**13Mxx Finite commutative rings {For number-theoretic aspects, see 12Cxx.}**  
 M05 Structure  
 M10 Polynomials  
 M99 None of the above, but in this section  
**13N05 Differential algebra [See also 12H05, 13B10.]**



**14-XX ALGEBRAIC GEOMETRY**

- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
- 01 Elementary exposition, textbooks
- 02 Advanced exposition (research surveys, monographs, etc.)
- 03 Historical (must also be assigned at least one classification number from Section 01)
- 04 Explicit machine computation and programs (not the theory of computation or programming)
- 06 Proceedings, conferences, etc.
- 14Axx Foundations**
  - A05 Relevant commutative algebra [See also 13-XX.]
  - A10 Varieties
  - A15 Schemes
  - A20 Generalizations (algebraic spaces, motifs)
  - A25 Elementary questions
  - A99 None of the above, but in this section
- 14Bxx Local theory [See also 32Bxx.]**
  - B05 Singularities [See also 14E15, 32B30, 32C40, 58C27.]
  - B07 Deformations of singularities [See also 14D15, 32C40, 32G05, 32G11, 32G13.]
  - B10 Infinitesimal methods
  - B12 Local deformation theory, Artin approximation, etc.
  - B15 Local cohomology [See also 32C36.]
  - B20 Formal neighborhoods
  - B25 Local structure of maps: étale, flat, etc. [See also 13-XX, 14E40.]
  - B99 None of the above, but in this section
- 14Cxx Cycles and subschemes**
  - C05 Parametrization (Chow and Hilbert schemes)
  - C10 Equivalence relations
  - C15 Rational equivalence rings
  - C17 Intersection theory
  - C20 Divisors, linear systems
  - C21 Webs, nets [See also 53A60.]
  - C22 Picard groups
  - C25 Zero-cycles
  - C30 Transcendental methods, Hodge theory [See also 32J25.]
  - C35 Applications of methods of algebraic  $K$ -theory [See also 14F05, 18F25.]
  - C40 Riemann-Roch theorems [See also 14F12.]
  - C99 None of the above, but in this section
- 14Dxx Families, fibrations**
  - D05 Structure of families (Picard-Lefschetz, Picard-Fuchs theory, etc.)
  - D10 Arithmetic ground fields (finite, local, global)
  - D15 Formal methods; deformations [See also 13D10, 14B07, 16A58, 32Gxx.]
  - D20 Algebraic moduli problems {For analytic moduli problems, see 32G13.}
  - D22 Fine structure of moduli spaces
  - D25 Geometric invariants [See also 14L30.]
  - D99 None of the above, but in this section
- 14Exx Mappings and correspondences**
  - E05 Rational maps, birational correspondences
  - E07 Structure of Cremona group and generalizations
  - E10 General correspondences
  - E15 Global theory of singularities, resolution [See also 14B05, 32C45.]
  - E20 Coverings, fundamental group
  - E22 Ramification problems [See also 12B10.]
  - E25 Imbeddings
  - E30 Minimal models
  - E35 Results in dimension  $\leq 3$
  - E40 Local structure of maps: étale, flat, etc. [See also 13-XX, 14B25.]
  - E99 None of the above, but in this section
- 14Fxx Cohomology theory [See also 13Dxx.]**
  - F05 Vector bundles, sheaves, related constructions [See also 18F20, 46M20.]
  - F07 Weierstrass points in one and several variables; gap sheaves
  - F10 Differentials and other special sheaves

- F12 Riemann-Roch problems [See mainly 14C40, also 32L10, 57R20.]
- F15 Serre cohomology,  $K$ -theory [See also 13D15, 18F25.]
- F20 Grothendieck cohomology and topology [See also 18F10.]
- F25 Classical real and complex cohomology
- F30  $p$ -adic cohomology, crystalline cohomology
- F35 Homotopy theory
- F40 de Rham cohomology [See also 14C30, 32C35, 32L10.]
- F45 Topological properties
- F99 None of the above, but in this section
- 14Gxx Special ground fields, arithmetic problems {For complex multiplication, see 10D25, 14K22. For automorphic and modular functions and forms, see also 10Dxx, 14K15.}**
  - G05 Rationality questions
  - G10 Zeta-functions and related questions [See also 12A70, 12B30.]
  - G13 Weil-Tate conjectures [See also 14Cxx.]
  - G15 Finite ground fields
  - G20  $p$ -adic ground fields (local fields)
  - G25 Global ground fields
  - G30 Real ground fields [See also 32C05. Must also be assigned at least one other number referring to the specific type of problem considered.]
  - G99 None of the above, but in this section
- 14Hxx Curves**
  - H05 Algebraic functions, abelian integrals and differentials [See also 14K20, 32G20.]
  - H10 Families, moduli (algebraic)
  - H15 Families, moduli (analytic) [See also 30F10, 32G15, 32G20.]
  - H20 Singularities, local rings [See also 13Hxx.]
  - H25 Arithmetic ground fields [See also 10Bxx, 14Gxx.]
  - H30 Coverings, fundamental group
  - H35 Correspondences [See also 14Exx.]
  - H40 Jacobians [See also 32G20.]
  - H45 Special curves
  - H99 None of the above, but in this section
- 14Jxx Surfaces and higher-dimensional varieties**
  - J05 Picard group
  - J10 Families, moduli, classification: algebraic theory
  - J15 Moduli, classification: analytic theory [See also 32J15.]
  - J17 Singularities of surfaces
  - J20 Arithmetic ground fields [See also 10Bxx, 14Gxx.]
  - J25 Special surfaces
  - J30 Special 3-folds [See also 14E05.]
  - J35 Special 4-folds [See also 14E05.]
  - J40 Special  $n$ -folds
  - J99 None of the above, but in this section
- 14Kxx Abelian varieties and schemes**
  - K05 Algebraic theory
  - K07 Elliptic curves, one-dimensional theory [See also 14H50.]
  - K10 Algebraic moduli, classification
  - K15 Arithmetic ground fields [See also 10Bxx, 10Dxx, 14Gxx.]
  - K20 Analytic theory
  - K22 Complex multiplication [See also 10D25.]
  - K25  $\vartheta$ -functions
  - K30 Picard schemes, higher Jacobians
  - K99 None of the above, but in this section
- 14Lxx Group schemes {For linear algebraic groups, see 20Gxx. For Lie algebras, see 17B45.}**
  - L05 Formal groups,  $p$ -divisible groups [See also 17B50.]
  - L10 Group varieties
  - L15 Group schemes
  - L17 Affine algebraic groups, hyperalgebra constructions [See also 17B45, 18D35.]
  - L20 Finite group schemes
  - L25 Pro-algebraic group schemes
  - L30 Group actions on varieties or schemes [See also 14D25.]
  - L35 Classical groups (geometric aspects)
  - L40 Other algebraic groups (geometric aspects)
  - L99 None of the above, but in this section



- 14Mxx Special varieties**
- M05 Varieties defined by ring conditions (factorial, Macaulay)
  - M07 Low-codimension problems [See also 14Cxx.]
  - M10 Complete intersections
  - M12 Determinantal varieties
  - M15 Grassmannians, Schubert varieties [See also 51M35.]
  - M17 Homogeneous spaces [See also 32M10, 53C30, 57T15.]
  - M20 Rational varieties
  - M99 None of the above, but in this section
- 14Nxx Classical methods and problems [See also 51-XX.]**
- N05 Projective techniques
  - N10 Enumerative problems
  - N99 None of the above, but in this section
- 5-XX LINEAR AND MULTILINEAR ALGEBRA; MATRIX THEORY (finite and infinite)**
- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
  - 01 Elementary exposition, textbooks
  - 02 Advanced exposition (research surveys, monographs, etc.)
  - 03 Historical (must also be assigned at least one classification number from Section 01)
  - 04 Explicit machine computation and programs (not the theory of computation or programming)
  - 06 Proceedings, conferences, etc.
  - A03 Vector spaces, linear dependence, rank
  - A04 Linear transformations, semilinear transformations
  - A06 Linear equations
  - A09 Matrix inversion, generalized inverses
  - A12 Conditioning of matrices [See also 65F35.]
  - A15 Determinants, permanents, other special matrix functions
  - A18 Eigenvalues, singular values, and eigenvectors
  - A21 Canonical forms, reductions, classification
  - A23 Factorization of matrices
  - A24 Matrix equations and identities
  - A27 Commutativity
  - A30 Algebraic systems of matrices [See also 16A42, 20Gxx, 20Hxx.]
  - A33 Matrices over special rings (quaternions, finite fields, etc.)
  - A36 Matrices of integers [See also 10M20.]
  - A39 Linear inequalities
  - A42 Inequalities involving eigenvalues and eigenvectors
  - A45 Miscellaneous inequalities involving matrices
  - A48 Positive matrices and their generalizations
  - A51 Stochastic matrices
  - A52 Random matrices
  - A54 Matrices over function rings in one or more variables
  - A57 Other types of matrices (Hermitian, skew-Hermitian, etc.)
  - A60 Norms of matrices, numerical range, applications of functional analysis to matrix theory [See also 65F35, 65J05.]
  - A63 Quadratic and bilinear forms, inner products [See mainly 10Cxx.]
  - A66 Clifford algebras
  - A69 Multilinear algebra, tensor products
  - A72 Vector and tensor algebra, theory of invariants
  - A75 Exterior algebra, Grassmann algebras
  - A78 Other algebras built from modules
  - A90 Applications to physics
  - A99 Miscellaneous topics
- 6-XX ASSOCIATIVE RINGS AND ALGEBRAS {For the commutative case, see 13-XX.}**
- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
  - 01 Elementary exposition, textbooks
  - 02 Advanced exposition (research surveys, monographs, etc.)
  - 03 Historical (must also be assigned at least one classification number from Section 01)
  - 04 Explicit machine computation and programs (not the theory of computation or programming)
  - 06 Proceedings, conferences, etc.
  - A02 Integral domains, unique factorization domains (noncommutative)
  - A03 Graded algebras, rings and modules
  - A04 Noncommutative principal ideal rings, rings with a division algorithm
  - A05 Skew polynomial rings, power series rings
  - A06 Free algebras, free ideal rings (firs) and their generalizations [See also tensor algebra in 15A72.]
  - A08 Rings of quotients, noncommutative localization
  - A10 Noncommutative local rings
  - A12 Prime and semiprime rings
  - A14 Noncommutative analogues of Dedekind and Prüfer domains
  - A15 Other generalizations of commutative rings (For commutativity theorems, see 16A70.)
  - A16 Separable algebras, Azumaya algebras and their generalizations [See also 12Gxx, 13A20.]
  - A18 Orders, arithmetic in algebras [See also 12A80, 12B35.]
  - A19 Simple non-Artinian rings
  - A20 Primitive and semiprimitive rings
  - A21 Radical theory
  - A22 Nil, nilpotent and radical rings
  - A24 Hopf algebras, algebraic theory [See also 57T05.]
  - A25 Structure of groups of units of rings
  - A26 Group rings of finite groups [See also 20C05; for semigroup rings, see 20M25.]
  - A27 Group rings of infinite groups [See also 20C07; for semigroup rings, see 20M25.]
  - A28 Rings with involution [See also 46Kxx.]
  - A30 von Neumann regular rings and their generalizations [See also 06Cxx, 06Exx.]
  - A32 Idempotents in rings [See also 06Exx.]
  - A33 Noetherian rings
  - A34 Rings with annihilator conditions, chain conditions (Goldie rings)
  - A35 Artinian rings
  - A36 Frobenius algebras, quasi-Frobenius rings and their generalizations
  - A38 Rings with polynomial identity
  - A39 Skew fields [See also 12E15.], division rings
  - A40 Simple and semisimple Artinian rings
  - A42 Rings of linear transformations, matrix rings, infinite matrix rings [See also 15A30.]
  - A44 Finite rings [See also 12Cxx, 13Mxx.]
  - A45 Other types of rings and algebras
  - A46 Finite-dimensional algebras
  - A48 Structure, classification
  - A49 Duality theory
  - A50 Projective and flat modules and generalizations
  - A51 Perfect, semiperfect rings and modules and their generalizations
  - A52 Injective modules, self-injective rings and generalizations
  - A53 Special types of modules
  - A54 Grothendieck groups of rings,  $K$ -theory of noncommutative rings [See also 18F25, 18F30.]
  - A55 Dimension theory (Krull, Gabriel)
  - A56 Extension theory
  - A58 Deformation theory of rings and algebras [See also 13D10, 14D15, 32Gxx.]
  - A60 Homological dimension
  - A61 Cohomology of algebras and rings
  - A62 Homological methods
  - A63 Torsion theories [See also 13D30, 18E40.]
  - A64 Modules and representations
  - A65 Endomorphism rings
  - A66 Ideal theory, prime ideals and their generalizations
  - A68 Lie, Jordan and other nonassociative structures on associative rings
  - A70 Commutativity theorems
  - A72 Automorphisms, derivations, other morphisms
  - A74 Galois theory
  - A76 Near-rings [See also 12K05.]
  - A78 Semirings and other generalizations of rings
  - A80 Topological rings and modules [See also 13Jxx.]
  - A86 Ordered rings [See also 06F25.]



- A89 Equivalence of module categories
- A90 Categorical methods and categorical ring theory
- A99 Miscellaneous topics

## 17-XX NONASSOCIATIVE RINGS AND ALGEBRAS

- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
- 01 Elementary exposition, textbooks
- 02 Advanced exposition (research surveys, monographs, etc.)
- 03 Historical (must also be assigned at least one classification number from Section 01)
- 04 Explicit machine computation and programs (not the theory of computation or programming)
- 06 Proceedings, conferences, etc.

### 17Axx General nonassociative rings

- A01 General theory
- A05 Power-associative
- A10 Commutative power-associative
- A15 Noncommutative Jordan algebras
- A20 Flexible algebras
- A25 Nodal algebras
- A30 Algebras satisfying other identities
- A35 Division algebras
- A40 Ternary compositions
- A42 Other  $n$ -ary compositions
- A45 Quadratic algebras (not quadratic Jordan algebras)
- A50 Free algebras
- A60 Structure theory in general nonassociative rings
- A65 Radical theory in general nonassociative rings
- A70 Super algebras
- A99 None of the above, but in this section

### 17Bxx Lie algebras {For Lie groups, see 22Exx.}

- B05 Structure theory
- B10 Representations, algebraic theory (weights)
- B15 Representations, analytic theory
- B20 Simple, semisimple, reductive algebras (roots)
- B25 Exceptional algebras
- B30 Solvable, nilpotent algebras
- B35 Universal enveloping algebras, imbeddings
- B40 Automorphisms, derivations, other operators
- B45 Lie algebras of linear algebraic groups [See also 14Lxx and 20Gxx.]
- B50 Modular Lie algebras
- B55 Homological methods in Lie algebras
- B56 Cohomology of Lie algebras
- B60 Lie rings associated with other structures (associative, Jordan, etc.) [See also 15A30, 16A68, 17C40, 17C50.]
- B65 Infinite-dimensional Lie algebras [See also 22E65.]
- B70 Graded Lie algebras
- B99 None of the above, but in this section

### 17Cxx Jordan algebras (commutative)

- C05 Identities
- C10 Structure theory
- C15 Representations
- C20 Simple, semisimple algebras
- C25 Universal enveloping algebras
- C30 Automorphisms, derivations, other operators
- C35 Formally real domains of positivity [See also 32Nxx.]
- C40 Exceptional Jordan algebras and associated Lie groups
- C45 Homological methods in Jordan algebras
- C46 Cohomology of Jordan algebras
- C50 Jordan rings associated with other structures [See also 16A68, 17B60.]
- C65 Infinite-dimensional Jordan algebras
- C99 None of the above, but in this section

### 17Dxx Other nonassociative rings and algebras

- D05 Alternative rings
- D10 Mal'cev rings
- D99 None of the above, but in this section

## 18-XX CATEGORY THEORY, HOMOLOGICAL ALGEBRA

- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
- 01 Elementary exposition, textbooks

- 02 Advanced exposition (research surveys, monographs, etc.)
- 03 Historical (must also be assigned at least one classification number from Section 01)
- 04 Explicit machine computation and programs (not the theory of computation or programming)
- 06 Proceedings, conferences, etc.

### 18Axx General theory of categories and functors

- A05 Definitions, generalizations
- A10 Graphs, diagram schemes, precategories, neocategories [See also 20Lxx.]
- A15 Foundations, relations to logic and deductive systems [See also 03-XX.]
- A20 Epimorphisms, monomorphisms, special classes of morphisms, null morphisms, factorization (bicategories)
- A22 Special properties of functors (faithful, full, etc.)
- A23 Natural morphisms, dinatural morphisms
- A25 Functor categories, comma categories
- A30 Limits and colimits (products, sums, directed limits, pushouts, fiber products, equalizers, kernels, ends and coends, etc.)
- A32 Factorization of morphisms (via images, coimages, dominions, codominions), substructures, quotient structures, congruences, amalgams
- A35 Categories admitting limits (complete categories), functors commuting with limits, continuous functors, completions
- A40 Adjoint functors (representable functors, universal constructions, reflective subcategories, reflections, etc.), constructions of adjoints (Kan extensions, etc.)
- A99 None of the above, but in this section

### 18Bxx Special categories

- B05 Category of sets, characterizations [See also 03-XX.]
- B10 Category of relations, additive relations
- B15 Imbedding theorems, universal categories [See also 18E20.]
- B20 Categories of machines, automata, operative categories [See also 03D05, 68Dxx, 68F10.]
- B25 Topoi [See also 03G25.]
- B30 Categories of topological spaces and continuous mappings [See also 54-XX.]
- B35 Preorders, orders and lattices (viewed as categories) [See also 06-XX.]
- B40 Groupoids, semigroupoids, semigroups, groups (viewed as categories) [See also 20Axx, 20Lxx, 20Mxx.]
- B99 None of the above, but in this section

### 18Cxx Categories and algebraic theories

- C05 Equational categories [See also 03-XX, 08C05.]
- C10 Theories (e.g. algebraic theories), structure, and semantics [See also 03-XX.]
- C15 Triples (= standard construction, monad or triad), algebras for a triple, homology and derived functors for triples [See also 18Gxx.]
- C20 Algebras and Kleisli categories associated with monads
- C99 None of the above, but in this section

### 18Dxx Categories with structure

- D05 Double categories, 2-categories, bicategories, hypercategories
- D10 Monoidal categories (= multiplicative categories)
- D15 Closed categories (closed monoidal and Cartesian closed categories, etc.)
- D20 Enriched categories (over closed or monoidal categories)
- D25 Strong functors, strong adjunctions
- D30 Fibered categories
- D35 Structured objects in a category (group objects, etc.)
- D99 None of the above, but in this section

### 18Exx Abelian categories

- E05 Preadditive, additive categories
- E10 Exact categories, abelian categories
- E15 Grothendieck categories
- E20 Imbedding theorems [See also 18B15.]
- E25 Derived functors and satellites
- E30 Derived categories, triangulated categories
- E35 Localization of categories
- E40 Torsion theories, radicals [See also 13D30, 16A63.]
- E99 None of the above, but in this section



**18Fxx Categories and geometry**

- F05 Local categories and functors
- F10 Grothendieck topologies [See also 14F20.]
- F15 Abstract manifolds and fiber bundles [See also 55Rxx, 57Pxx.]
- F20 Presheaves and sheaves [See also 14F05, 32C35, 32L10, 55N30.]
- F25 Algebraic  $K$ -theory and  $L$ -theory [See also 10Cxx, 12-XX, 13D15, 14Cxx, 16A54, 57R65, 57R67.]
- F30 Grothendieck groups [See also 13D15, 16A54.]
- F99 None of the above, but in this section

**18Gxx Homological algebra [See also 55Uxx.]**

- G05 Projectives and injectives [See also 13C10, 13C11, 16A50, 16A52.]
- G10 Resolutions; derived functors [See also 18E25.]
- G15 Ext and Tor, generalizations, Künneth formula [See also 55U25.]
- G20 Homological dimension [See also 13Dxx, 16A60, 16A62.]
- G25 Relative homological algebra, projective classes
- G30 Simplicial sets, simplicial objects (in a category) [See also 55U10.]
- G35 Chain complexes [See also 18E30, 55U15.]
- G40 Spectral sequences, hypercohomology [See also 55Txx.]
- G50 Nonabelian homological algebra
- G55 Nonabelian homotopical algebra
- G99 None of the above, but in this section

**20-XX GROUP THEORY AND GENERALIZATIONS**

- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
- 01 Elementary exposition, textbooks
- 02 Advanced exposition (research surveys, monographs, etc.)
- 03 Historical (must also be assigned at least one classification number from Section 01)
- 04 Explicit machine computation and programs (not the theory of computation or programming)
- 06 Proceedings, conferences, etc.

**20Axx Foundations**

- A05 Axiomatics and elementary properties
- A10 Metamathematical considerations (For word problems, see 20F10.)
- A15 Applications of logic to group theory
- A99 None of the above, but in this section

**20Bxx Permutation groups**

- B05 General theory for finite groups
- B07 General theory for infinite groups
- B10 Characterization theorems
- B15 Uniprimitive groups
- B20 Multiply transitive finite groups
- B22 Multiply transitive infinite groups
- B25 Finite automorphism groups of algebraic, geometric, or combinatorial structures [See also 05Bxx, 12F10, 20G40, 20H30, 51-XX.]
- B27 Infinite automorphism groups [See also 12F10.]
- B30 Symmetric groups, general
- B35 Subgroups of symmetric groups
- B99 None of the above, but in this section

**20Cxx Representation theory of groups**

- C05 Group rings of finite groups and their modules [See also 16A26.]
- C07 Group rings of infinite groups and their modules [See also 16A27.]
- C10 Integral representations of finite groups
- C11  $p$ -adic representations of finite groups
- C12 Integral representations of infinite groups
- C15 Ordinary representations and characters
- C20 Modular representations and characters
- C25 Projective representations and multipliers
- C30 Representations of finite symmetric groups and other special finite groups
- C32 Representations of infinite symmetric groups and other special infinite groups
- C35 Applications to physics
- C99 None of the above, but in this section

**20Dxx Abstract finite groups**

- D05 Classification of simple and nonsolvable groups
- D06 Simple groups: alternating and classical groups [See also 20Gxx, 22Exx.]
- D08 Simple groups: sporadic groups
- D10 Solvable groups, theory of formations,  $\pi$ -length, ranks, factorable groups,  $p$ -groups
- D15 Nilpotent groups,  $p$ -groups
- D20 Sylow subgroups, Sylow properties,  $\pi$ -groups,  $\pi$ -structure
- D25 Special subgroups (Frattini, Fitting, etc.)
- D30 Series and lattices of subgroups
- D35 Subnormal subgroups
- D40 Products of subgroups
- D45 Automorphisms
- D50 Covering of subgroups
- D60 Arithmetic and combinatorial problems
- D99 None of the above, but in this section

**20Exx Structure and classification of infinite or finite groups**

- E05 Free nonabelian groups
- E06 Free products, free products with amalgamation, Higman-Neumann-Neumann extensions, and generalizations
- E07 Subgroup theorems
- E10 Varieties of groups
- E15 Chains and lattices of subgroups, subnormal subgroups [See also 20F22.]
- E18 Limits, profinite groups
- E22 Extensions, wreath products, and other compositions
- E25 Local properties
- E26 Residual properties and generalizations
- E28 Maximal subgroups, minimal subgroups
- E32 Simple groups [See also 20D05.]
- E34 General structure theorems
- E36 General theorems concerning automorphisms of groups
- E99 None of the above, but in this section

**20Fxx Special aspects of infinite or finite groups**

- F05 Generators, relations, and presentations
- F06 Cancellation theory
- F10 Word problems, other decision problems, connections with logic and automata [See also 03D05, 03D40, 06B25, 08A50, 68Dxx, 68F10.]
- F12 Commutator calculus
- F14 Derived series, central series, and generalizations
- F16 Solvable groups, supersolvable groups
- F18 Nilpotent groups
- F19 Generalizations of solvable and nilpotent groups
- F22 Other classes of groups defined by subgroup chains
- F24 FC-groups and their generalizations
- F26 Special subgroups
- F28 Automorphism groups of groups [See also 20E36.]
- F29 Representations of groups as automorphism groups of algebraic systems
- F32 Geometric group theory [See also 05C25, 20Exx, 20Gxx.]
- F34 Fundamental groups and their automorphisms [See also 57M05, 57Sxx.]
- F36 Braid groups
- F38 Other groups related to topology or analysis
- F40 Associated Lie structures
- F45 Engel conditions
- F50 Periodic groups
- F60 Ordered groups [See mainly 06F15.]
- F99 None of the above, but in this section

**20Gxx Linear algebraic groups (classical groups) {For arithmetic theory, see 10C30, 10E45; for geometric theory, see 14Lxx, 22Exx; for other methods in representation theory, see 22E45, 22E46, 22E47, 22E50, 22E55.}**

- G05 Representation theory
- G10 Cohomology theory
- G15 Linear algebraic groups over arbitrary fields
- G20 Linear algebraic groups over the reals, the complexes, the quaternions
- G25 Linear algebraic groups over local fields and their integers



- G30 Linear algebraic groups over global fields and their integers
- G35 Linear algebraic groups over adèles and other rings and schemes
- G40 Linear algebraic groups over finite fields
- G45 Applications to physics; explicit representations
- G99 None of the above, but in this section
- 20Hxx Other groups of matrices**
  - H05 Unimodular groups, congruence subgroups [See also 10D07, 22E40, 51F20.]
  - H10 Fuchsian groups and their generalizations [See also 10D07, 22E40, 30F35, 32Nxx.]
  - H15 Other geometric groups, including crystallographic groups [See also 51-XX, especially 51F15.]
  - H20 Other matrix groups over fields
  - H25 Other matrix groups over rings
  - H30 Other matrix groups over finite fields
  - H99 None of the above, but in this section
- 20Jxx Connections with homological algebra and category theory**
  - J05 Homological methods in group theory
  - J06 Cohomology of finite groups
  - J10 Groups arising as cohomology groups
  - J15 Category of groups
  - J99 None of the above, but in this section
- 20Kxx Abelian groups**
  - K01 Finite abelian groups
  - K05 Finitely generated groups
  - K10 Torsion groups, primary groups and generalized primary groups
  - K12 Ulm sequences
  - K15 Torsion free groups, finite rank
  - K20 Torsion free groups, infinite rank
  - K21 Mixed groups
  - K25 Direct sums, direct products, etc.
  - K26 Indecomposable groups
  - K27 Subgroups
  - K30 Automorphisms, homomorphisms, endomorphisms, etc.
  - K35 Extensions
  - K40 Homological and categorical methods
  - K45 Topological methods
  - K99 None of the above, but in this section
- 20Lxx Groupoids (small categories in which all morphisms are isomorphisms)**
  - L05 General theory
  - L10 Connections with group theory
  - L13 Mappings of groupoids
  - L15 Connections with topology
  - L17 Connections with category theory
  - L99 None of the above, but in this section
- 20Mxx Semigroups**
  - M05 Free semigroups, generators and relations, word problem
  - M07 Varieties of semigroups
  - M10 General structure theory
  - M11 Radical theory
  - M12 Ideal theory
  - M14 Commutative subgroups
  - M15 Mappings of semigroups
  - M20 Semigroups of transformations, etc. [See also 47D05, 47H20, 54H15.]
  - M25 Semigroup rings, multiplicative semigroups of rings
  - M30 Representation of semigroups
  - M35 Semigroups in automata theory, linguistics, etc. [See also 03D05, 68D30, 68Fxx.]
  - M50 Connections with homological algebra and category theory
  - M99 None of the above, but in this section
- 20Nxx Other generalizations of groups**
  - N05 Loops, quasigroups [See also 05Bxx.]
  - N07 Mappings of loops
  - N10 Ternary systems (heaps, semiheaps, heapoids, etc.)
  - N15  $n$ -ary systems
  - N99 None of the above, but in this section
- 20P05 Probability methods in group theory**

- 22-XX TOPOLOGICAL GROUPS, LIE GROUPS {For transformation groups, see 54H15, 57Sxx, 58-XX. For abstract harmonic analysis, see 43-XX.}**
  - 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
  - 01 Elementary exposition, textbooks
  - 02 Advanced exposition (research surveys, monographs, etc.)
  - 03 Historical (must also be assigned at least one classification number from Section 01)
  - 04 Explicit machine computation and programs (not the theory of computation or programming)
  - 06 Proceedings, conferences, etc.
- 22Axx Topological algebraic systems {For topological rings and fields, see 12Jxx, 13Jxx, 16A80; for dual spaces of operator algebras and topological groups, see 47D35.}**
  - A05 Structure of general topological groups
  - A10 Analysis on general topological groups
  - A15 Structure of topological semigroups
  - A20 Analysis on topological semigroups
  - A25 Representations of general topological groups and semigroups
  - A26 Topological semilattices, lattices and applications [See also 06B30, 06F30.]
  - A30 Other topological algebraic systems and their representations
  - A99 None of the above, but in this section
- 22Bxx Locally compact abelian groups (LCA groups)**
  - B05 General properties and structure of LCA groups
  - B10 Structure of group algebras of LCA groups
  - B99 None of the above, but in this section
- 22C05 Compact groups**
- 22Dxx Locally compact groups and their algebras**
  - D05 General properties and structure of locally compact groups
  - D10 Unitary representations of locally compact groups
  - D12 Other representations of locally compact groups
  - D15 Group algebras of locally compact groups
  - D20 Representations of group algebras
  - D25  $C^*$ -algebras and  $W^*$ -algebras arising from group representations [See also 46Lxx.]
  - D30 Induced representations
  - D35 Duality theorems
  - D40 Ergodic theory on groups [See also 28Dxx and 43A60.]
  - D45 Automorphism groups of locally compact groups
  - D99 None of the above, but in this section
- 22Exx Lie groups {For the topology of Lie groups and homogeneous spaces, see 57Sxx, 57Txx; for the analysis thereon, see 43A80, 43A85, 43A90.}**
  - E05 Local Lie groups [See also 34-XX, 35-XX, 58H05.]
  - E10 General properties and structure of complex Lie groups [See also 32M05.]
  - E15 General properties and structure of real Lie groups
  - E20 General properties and structure of other Lie groups
  - E25 Nilpotent and solvable Lie groups
  - E27 Representations of nilpotent and solvable Lie groups (special orbital integrals, non-Type I representations, etc.)
  - E30 Analysis on real and complex Lie groups [See also 33A75, 43-XX.]
  - E35 Analysis on  $p$ -adic Lie groups [See also 12A85.]
  - E40 Discrete subgroups of Lie groups [See also 20Hxx and 32Nxx.]
  - E43 Structure and representation of the Lorentz group
  - E45 Representations of Lie and linear algebraic groups over real fields: analytic methods {For the purely algebraic theory, see 20G05.}
  - E46 Semi-simple Lie groups and their representations
  - E47 Representations of Lie and real algebraic groups: algebraic methods (Verma modules, etc.) [See also 17B35.]
  - E50 Representations of Lie and linear algebraic groups over local fields
  - E55 Representations of Lie and linear algebraic groups over global fields and adèle rings [See also 20G05.]
  - E60 Lie algebras of Lie groups {For the algebraic theory of Lie algebras, see 17Bxx.}



- E65 Infinite-dimensional Lie groups and their Lie algebras [See also 17B65, 58B25, 58H05.]
- E70 Applications of Lie groups to physics; explicit representations [See also 81C40, 81Gxx.]
- E99 None of the above, but in this section

## 26-XX REAL FUNCTIONS [See also 54C30.]

- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
- 01 Elementary exposition, textbooks
- 02 Advanced exposition (research surveys, monographs, etc.)
- 03 Historical (must also be assigned at least one classification number from Section 01)
- 04 Explicit machine computation and programs (not the theory of computation or programming)
- 06 Proceedings, conferences, etc.

### 26Axx Functions of one variable

- A03 Foundations: limits and generalizations, elementary topology of the line
- A06 One-variable calculus
- A09 Elementary functions
- A12 Rate of growth of functions, orders of infinity, slowly increasing functions [See also 26A48.]
- A15 Continuity and related questions (modulus of continuity, semicontinuity, discontinuities, etc.) {For properties determined by Fourier coefficients, see 42A16; for those determined by approximation properties, see 41A25.}
- A16 Lipschitz (Hölder) classes
- A18 Iteration [See also 39B10, 47H10, 54H25.]
- A21 Classification of real functions; Baire classification of sets and functions [See also 04A15, 28A05, 54C50.]
- A24 Differentiation (functions of one variable): general theory, generalized derivatives, mean-value theorems [See also 28A15.]
- A27 Nondifferentiability (nondifferentiable functions, points of nondifferentiability), discontinuous derivatives
- A30 Singular functions, Cantor functions, functions with other special properties
- A33 Fractional derivatives and integrals
- A36 Antidifferentiation
- A39 Denjoy and Perron integrals, other special integrals
- A42 Integrals of Riemann, Stieltjes and Lebesgue type [See also 28-XX.]
- A45 Functions of bounded variation, generalizations
- A46 Absolutely continuous functions
- A48 Monotonic functions, generalizations
- A51 Convexity, generalizations
- A99 None of the above, but in this section

### 26Bxx Functions of several variables

- B05 Continuity and differentiation questions
- B10 Implicit function theorems, Jacobians, transformations with several variables
- B12 Calculus of vector functions
- B15 Integration: length, area, volume [See also 28A75, 51M25.]
- B20 Integral formulas (Stokes, Gauss, Green, etc.)
- B25 Convexity, generalizations
- B30 Absolutely continuous functions, functions of bounded variation
- B35 Special properties of functions of several variables, Hölder conditions, etc.
- B40 Representation and superposition of functions
- B99 None of the above, but in this section

### 26Cxx Polynomials, rational functions

- C05 Polynomials: analytic properties, inequalities, etc.
- C10 Polynomials: location of zeros [See also 12D10, 30C15, 65H05.]
- C15 Rational functions [See also 14G30.]
- C99 None of the above, but in this section

### 26Dxx Inequalities {For maximal function inequalities, see 42B25; for functional inequalities, see 39C05.}

- D05 Inequalities for trigonometric functions and polynomials
- D10 Inequalities involving derivatives and differential and integral operators

- D15 Inequalities for sums, series and integrals

- D20 Other analytical inequalities

- D99 None of the above, but in this section

### 26Exx Miscellaneous topics [See also 58Cxx.]

- E05 Real-analytic functions
- E10  $C^\infty$ -functions, quasi-analytic functions
- E15 Calculus of functions on infinite-dimensional spaces
- E20 Calculus of functions taking values in infinite-dimensional spaces
- E25 Set-valued functions [See also 54C60.]
- E30 Non-Archimedean analysis [See also 12J25.]
- E35 Nonstandard analysis [See also 03H05.]
- E99 None of the above, but in this section

## 28-XX MEASURE AND INTEGRATION {For analysis on manifolds, see 58-XX.}

- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
- 01 Elementary exposition, textbooks
- 02 Advanced exposition (research surveys, monographs, etc.)
- 03 Historical (must also be assigned at least one classification number from Section 01)
- 04 Explicit machine computation and programs (not the theory of computation or programming)
- 06 Proceedings, conferences, etc.

### 28Axx Classical measure theory

- A05 Classes of sets (Borel fields,  $\sigma$ -rings, etc.), measurable sets, Suslin sets, analytic sets [See also 04A15, 26A21, 54H05.]
- A10 Real- or complex-valued set functions
- A12 Contents, measures, outer measures, capacities
- A15 Abstract differentiation theory, differentiation of set functions [See also 26A24.]
- A20 Measurable and nonmeasurable functions, sequences of measurable functions, modes of convergence
- A25 Integration with respect to measures and other set functions
- A33 Spaces of measures, convergence of measures [See also 46E27, 60Bxx.]
- A35 Measures and integrals in product spaces
- A50 Integration and disintegration of measures
- A51 Lifting theory [See also 46G15.]
- A60 Measures on Boolean rings, measure algebras [See also 54H10.]
- A75 Length, area, volume, other geometric measure theory [See also 26B15, 49F20.]
- A99 None of the above, but in this section

### 28Bxx Measures and integrals with values in abstract spaces

- B05 Vector-valued measures and integrals [See also 46G10.]
- B10 Group- or semigroup-valued measures and integrals
- B15 Measures and integrals with values in general ordered systems
- B20 Set-valued measures; integration of set-valued functions; measurable selections [See also 54C60, 54C65.]
- B99 None of the above, but in this section

### 28Cxx Measures on spaces with additional structure [See also 58C35, 58D20.]

- C05 Integration theory via linear functionals (Radon measures, Daniell integrals, etc.), representing measures
- C10 Measures on topological groups, Haar measures, invariant measures [See also 43A05.]
- C15 Measures on topological spaces (regularity of measures, etc.)
- C20 Measures and integrals in function spaces (Wiener measure, Gauss measure, etc.) [See also 58D20, 60B11.]
- C99 None of the above, but in this section

### 28Dxx Measure-theoretic ergodic theory [See also 22D40, 47A35, 54H20, 58Fxx, 60Fxx, 60G10.]

- D05 Measure-preserving transformations
- D10 One-parameter continuous families of measure-preserving transformations
- D15 General groups of measure-preserving transformations
- D20 Entropy and other invariants
- D99 None of the above, but in this section



### 30-XX FUNCTIONS OF A COMPLEX VARIABLE {For analysis on manifolds, see 58-XX.}

- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
- 01 Elementary exposition, textbooks
- 02 Advanced exposition (research surveys, monographs, etc.)
- 03 Historical (must also be assigned at least one classification number from Section 01)
- 04 Explicit machine computation and programs (not the theory of computation or programming)
- 06 Proceedings, conferences, etc.

#### 30Axx General properties

- A05 Monogenic properties of complex functions (including polygenic and areolar monogenic functions)
- A10 Inequalities in the complex domain
- A99 None of the above, but in this section

#### 30Bxx Series expansions

- B10 Power series (including lacunary series)
- B20 Random power series
- B30 Boundary behavior of power series, over-convergence
- B40 Analytic continuation
- B50 Dirichlet series and other series expansions, exponential series [See also 40-XX, 41-XX, 42-XX.]
- B60 Completeness problems, closure of a system of functions
- B70 Continued fractions [See also 10A32, 40A15.]
- B99 None of the above, but in this section

#### 30Cxx Geometric function theory

- C10 Polynomials
- C15 Zeros of polynomials, rational functions, and other analytic functions (e.g. zeros of functions with bounded Dirichlet integral) {For algebraic theory, see 12D10; for real methods, see 26C10.}
- C20 Conformal mappings of special domains
- C25 Covering theorems in conformal mapping theory
- C30 Numerical methods in conformal mapping theory [See also 65E05.]
- C35 General theory of conformal mappings
- C40 Kernel functions and applications
- C45 Special classes of univalent and multivalent functions (star-like, convex, bounded rotation, etc.)
- C50 Coefficient problems for univalent and multivalent functions
- C55 General theory of univalent and multivalent functions
- C60 Quasiconformal mappings
- C70 Extremal problems for conformal and quasiconformal mappings, variational methods
- C75 Extremal problems for conformal and quasiconformal mappings, other methods
- C80 Maximum principle; Schwarz' lemma, Lindelöf principle, analogues and generalizations; subordination
- C85 Capacity and harmonic measure in the complex plane [See also 31A15.]
- C99 None of the above, but in this section

#### 30Dxx Entire and meromorphic functions, and related topics

- D05 Functional equations in the complex domain, iteration and composition of analytic functions [See also 34A20, 39-XX.]
- D10 Representations of entire functions by series and integrals
- D15 Special classes of entire functions and growth estimates
- D20 Entire functions, general theory
- D30 Meromorphic functions, general theory
- D35 Distribution of values, Nevanlinna theory
- D40 Cluster sets, prime ends, boundary behavior
- D45 Normal functions, normal families
- D50 Blaschke products, bounded characteristic, bounded functions, functions with positive real part
- D55  $H^p$ -classes
- D60 Quasianalytic and other classes of functions
- D99 None of the above, but in this section

#### 30Exx Miscellaneous topics of analysis in the complex domain

- E05 Moment problems, interpolation problems
- E10 Approximation in the complex domain
- E15 Asymptotic representations in the complex domain

- E20 Integration, integrals of Cauchy type, integral representations of analytic functions [See also 45Exx.]

- E25 Boundary value problems [See also 45Exx.]

- E99 None of the above, but in this section

#### 30Fxx Riemann surfaces

- F10 Compact Riemann surfaces and uniformization [See also 14H15, 32G15.]
- F15 Harmonic functions on Riemann surfaces
- F20 Classification theory of Riemann surfaces
- F25 Ideal boundary theory
- F30 Differentials on Riemann surfaces
- F35 Fuchsian groups and automorphic functions [See also 10Dxx, 20H10, 32Gxx, 32Nxx.]
- F40 Kleinian groups [See also 20H10.]
- F99 None of the above, but in this section

#### 30Gxx Generalized function theory

- G05 Non-Archimedean function theory [See also 12J25.]
- G10 Nonstandard function theory [See also 03H05.]
- G15 Topological function theory
- G20 Generalizations of Vekua type (pseudoanalytic,  $p$ -analytic, etc.)
- G25 Discrete analytic functions
- G30 Other generalizations of analytic functions (including abstract-valued functions)
- G35 Functions of hypercomplex variables and generalized variables
- G99 None of the above, but in this section

#### 30H05 Spaces and algebras of analytic functions [See also 32E25, 46Exx, 46J15.]

### 31-XX POTENTIAL THEORY {For probabilistic potential theory, see 60J45.}

- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
- 01 Elementary exposition, textbooks
- 02 Advanced exposition (research surveys, monographs, etc.)
- 03 Historical (must also be assigned at least one classification number from Section 01)
- 04 Explicit machine computation and programs (not the theory of computation or programming)
- 06 Proceedings, conferences, etc.

#### 31Axx Two-dimensional theory

- A05 Harmonic, subharmonic, superharmonic functions
- A10 Integral representations
- A15 Potentials and capacity, harmonic measure, extremal length [See also 30C85.]
- A20 Boundary behavior (theorems of Fatou type, etc.)
- A25 Boundary value and inverse problems
- A30 Biharmonic, polyharmonic functions and equations, Poisson's equation
- A35 Connections with differential equations
- A99 None of the above, but in this section

#### 31Bxx Higher-dimensional theory

- B05 Harmonic, subharmonic, superharmonic functions
- B10 Integral representations
- B15 Potentials and capacities, extremal length
- B20 Boundary value and inverse problems
- B25 Boundary behavior
- B30 Biharmonic and polyharmonic equations and functions
- B35 Connections with differential equations
- B99 None of the above, but in this section

#### 31Cxx Other generalizations

- C05 Harmonic, subharmonic, superharmonic functions
- C10 Pluriharmonic and plurisubharmonic functions [See also 32F05.]
- C12 Potential theory on Riemannian manifolds [See also 53C20; for Hodge theory, see 58A14.]
- C15 Potentials and capacities
- C20 Discrete potential theory and numerical methods
- C25 Dirichlet spaces
- C99 None of the above, but in this section

#### 31D05 Axiomatic potential theory



### 32-XX SEVERAL COMPLEX VARIABLES AND ANALYTIC SPACES (For infinite-dimensional holomorphy, see also 46G20, 58B12.)

- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
- 01 Elementary exposition, textbooks
- 02 Advanced exposition (research surveys, monographs, etc.)
- 03 Historical (must also be assigned at least one classification number from Section 01)
- 04 Explicit machine computation and programs (not the theory of computation or programming)
- 06 Proceedings, conferences, etc.
- 32Axx Holomorphic functions of several complex variables**
  - A05 Power series, series of functions
  - A07 Special domains (Reinhardt, Hartogs, tube domains, etc.)
  - A10 Holomorphic functions
  - A15 Entire functions
  - A17 Normal families
  - A20 Meromorphic functions
  - A22 Nevanlinna theory: growth estimates (For geometric theory, see 32H25, 32H30.)
  - A25 Integral representation
  - A27 Local theory of residues [See also 32C30.]
  - A30 Other generalizations of function theory of one complex variable (should also be assigned at least one classification number from Section 30) (For functions of several hypercomplex variables, see 30G35.)
  - A35  $H^p$ -spaces [See also 32M15, 42B30, 43A85, 46J15.]
  - A40 Boundary behavior
  - A45 Hyperfunctions [See also 46F15.]
  - A99 None of the above, but in this section
- 32Bxx Local analytic geometry [See also 13-XX and 14-XX.]**
  - B05 Analytic algebra and generalizations, preparation theorems
  - B10 Germs of analytic sets
  - B15 Analytic subsets of affine space
  - B20 Semi-analytic sets and subanalytic sets
  - B25 Triangulation and related questions
  - B30 Local singularities [See also 14B05, 32C40, 32C42.]
  - B99 None of the above, but in this section
- 32Cxx General theory of analytic spaces**
  - C05 Real-analytic manifolds, real-analytic spaces [See also 14G30, 58A07.]
  - C10 Complex manifolds (For almost complex manifolds, see 53C15.)
  - C15 Complex spaces
  - C20 Normal analytic spaces
  - C25 Analytic subsets and submanifolds
  - C30 Integration on analytic sets and spaces, currents (For local theory, see 32A25 or 32A27.)
  - C35 Analytic sheaves and cohomology groups [See also 14Fxx, 18F20, 55N30.]
  - C36 Local cohomology of analytic spaces
  - C37 Duality theorems
  - C40 Singularities
  - C42 Stratified sets, etc. [See also 32Bxx.]
  - C45 Modifications, resolution of singularities [See also 14E15.]
  - C99 None of the above, but in this section
- 32Dxx Analytic continuation**
  - D05 Domains of holomorphy
  - D10 Envelopes of holomorphy
  - D15 Continuation of analytic objects
  - D20 Removable singularities
  - D25 Non-Archimedean function theory
  - D99 None of the above, but in this section
- 32Exx Holomorphic convexity**
  - E05 Holomorphically convex complex spaces, reduction theory
  - E10 Stein spaces, Stein manifolds
  - E15 Runge pairs
  - E20 Polynomial convexity
  - E25 Algebras of holomorphic functions [See also 30H05, 46J10, 46J15.]
  - E27 Krasner-Tate algebras, etc. (algebras of holomorphic functions over non-Archimedean fields)

- E30 Holomorphic and polynomial approximation
- E35 Global boundary behavior of holomorphic functions
- E99 None of the above, but in this section
- 32Fxx Geometric convexity**
  - F05 Plurisubharmonic functions and generalizations [See also 31C10.]
  - F10  $q$ -convexity,  $q$ -concavity
  - F15 Pseudoconvex domains
  - F20 Geometric results on  $\bar{\partial}$ -Neumann problems [See also 32N15.]
  - F25 Real hypersurfaces in complex manifolds
  - F30 Pseudoconvex manifolds
  - F99 None of the above, but in this section
- 32Gxx Deformations of analytic structures**
  - G05 Deformations of complex structures [See also 13D10, 16A58, 58H10, 58H15.]
  - G07 Deformations of special (e.g. CR) structures
  - G10 Deformations of submanifolds and subspaces
  - G11 Deformations of singularities
  - G13 Analytic moduli problems (For algebraic moduli problems, see 14D20.)
  - G15 Moduli of Riemann surfaces, Teichmüller theory [See also 14H15, 30Fxx.]
  - G20 Period matrices [See also 14H05.]
  - G99 None of the above, but in this section
- 32Hxx Holomorphic mappings**
  - H05 Representative domains
  - H10 Bergman kernel function
  - H15 Invariant metrics and pseudodistances
  - H20 Hyperbolic complex manifolds
  - H25 Picard type theorems and generalizations (For function-theoretic properties, see 32A22.)
  - H30 Value distribution theory in higher dimensions (For function-theoretic properties, see 32A22.)
  - H99 None of the above, but in this section
- 32Jxx Compact analytic spaces (For Riemann surfaces, see 14Hxx, 30Fxx.)**
  - J05 Compactification
  - J10 Algebraic dependence theorems
  - J15 Compact surfaces
  - J20 Algebraicity criteria
  - J25 Transcendental methods of algebraic geometry [See also 14C30.]
  - J99 None of the above, but in this section
- 32Kxx Generalizations of analytic spaces (should also be assigned at least one other classification number in this section)**
  - K05 Banach analytic spaces [See also 58Bxx.]
  - K10 Non-Archimedean analytic spaces
  - K15 Differentiable functions on analytic spaces, differentiable spaces [See also 58C25.]
  - K99 None of the above, but in this section
- 32Lxx Holomorphic fiber spaces [See also 55Rxx.]**
  - L05 Holomorphic fiber bundles and generalizations
  - L10 Sheaves and cohomology of sections of holomorphic vector bundles, general results [See also 18F20, 55N30.]
  - L15 Bundle convexity [See also 32F10.]
  - L20 Vanishing theorems
  - L99 None of the above, but in this section
- 32Mxx Complex spaces with a group of automorphisms**
  - M05 Complex Lie groups, automorphism groups of complex spaces [See also 22E10.]
  - M10 Homogeneous complex manifolds [See also 14M17, 57T15.]
  - M15 Hermitian symmetric spaces, bounded symmetric domains [See also 22E10, 22E40, 53C35, 57T15.]
  - M99 None of the above, but in this section
- 32Nxx Automorphic functions [See also 10Dxx, 20H10, 22E40, 30F35.]**
  - N05 General theory of automorphic functions of several complex variables
  - N10 Automorphic forms



- N15 Automorphic functions in symmetric domains
- N99 None of the above, but in this section

**33-XX SPECIAL FUNCTIONS {33-XX deals with the properties of functions as functions. General systems of orthogonal functions are treated in 42C05. Expansions in orthogonal functions are treated in 42C10, 42C15.}**

- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
- 01 Elementary exposition, textbooks
- 02 Advanced exposition (research surveys, monographs, etc.)
- 03 Historical (must also be assigned at least one classification number from Section 01)
- 04 Explicit machine computation and programs (not the theory of computation or programming)
- 06 Proceedings, conferences, etc.
- A10 Exponential and trigonometric functions
- A15 Gamma and beta functions
- A20 Error function, probability integral
- A25 Elliptic functions and integrals
- A30 Simple hypergeometric functions of one and several variables
- A35 Generalized hypergeometric functions of one and several variables, (*E*-functions, *G*-functions, *H*-functions, etc.)
- A40 Cylindrical functions, Bessel functions
- A45 Spherical functions (Legendre polynomials and functions, spherical harmonics), ultraspherical polynomials
- A50 Gegenbauer functions
- A55 Lamé, Mathieu, spheroidal wave functions
- A60 Other wave functions
- A65 Orthogonal special functions and polynomials (Čebyšev, Hermite, Jacobi, Laguerre, etc.)
- A70 Other special functions
- A75 Special functions and Lie groups
- A99 Miscellaneous topics

**34-XX ORDINARY DIFFERENTIAL EQUATIONS**

- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
- 01 Elementary exposition, textbooks
- 02 Advanced exposition (research surveys, monographs, etc.)
- 03 Historical (must also be assigned at least one classification number from Section 01)
- 04 Explicit machine computation and programs (not the theory of computation or programming)
- 06 Proceedings, conferences, etc.

**34Axx General theory**

- A05 Solutions in closed form, integration by quadratures, reduction of differential equations
- A08 Equations not solved with respect to the highest-order derivative, singular solutions
- A10 Initial value problems: general existence and uniqueness theorems; continuous dependence of solutions on parameters, initial conditions and boundary conditions [See also 45D05.]
- A15 Initial value problems: continuation of solutions
- A20 Differential equations in the complex domain [See also 30D05.]
- A25 Analytical theory: series, transformations, transforms, operational calculus, etc. [See also 44-XX, 47E05.]
- A30 Linear equations and systems
- A34 Nonlinear equations and systems, general
- A35 Differential equations of infinite order
- A40 Differential inequalities
- A45 Theoretical approximation of solutions
- A50 Numerical approximation of solutions {For numerical analysis, see 65Lxx.}
- A55 Inverse problems
- A60 Equations with multivalued right-hand sides [See also 49A50, 49E10.]
- A99 None of the above, but in this section

**34Bxx Boundary value problems**

- B05 Linear equations
- B10 Multipoint boundary value problems

- B15 Nonlinear boundary value problems
- B20 Weyl theory and its generalizations
- B25 Spectral theory, Sturm-Liouville, and scattering theory; eigenfunctions, eigenvalues, and expansions [See also 42-XX, 43-XX, 45C05, 47Axx, 47Bxx, 47E05.]
- B27 Green functions
- B30 Special equations (Mathieu, Hill, Bessel, etc.) [See also 33-XX.]
- B99 None of the above, but in this section

**34Cxx Qualitative theory**

- C05 Location of integral curves, singular points, limit cycles
- C10 Zeros, disconjugacy, oscillation of solutions
- C11 Growth, boundedness, comparison of solutions
- C15 Nonlinear oscillations
- C20 Transformation and reduction of equations and systems
- C25 Periodic solutions
- C27 Almost-periodic solutions
- C28 Other types of "recurrent" solutions
- C29 Averaging method [See also 47H10.]
- C30 Manifolds of solutions
- C35 Dynamical systems [See also 54H20, 58Fxx, 70-XX.]
- C40 Equations and systems on manifolds [See mainly 58Fxx, 58Gxx.]
- C45 Method of integral manifolds
- C50 Method of accelerated convergence
- C99 None of the above, but in this section

**34Dxx Stability theory [See also 58F10, 93Dxx.]**

- D05 Asymptotic properties; characteristic exponents
- D10 Perturbations
- D15 Singular perturbations
- D20 Ljapunov stability
- D25 Popov-type stability
- D30 Structural stability and analogous concepts [See also 58Fxx.]
- D40 Ultimate boundedness
- D99 None of the above, but in this section

**34Exx Asymptotic theory**

- E05 Asymptotic expansions
- E10 Perturbations
- E15 Singular perturbations, general theory
- E20 Singular perturbations, turning point theory, WKB-methods
- E99 None of the above, but in this section

**34F05 Equations and systems with randomness [See also 60H10, 93Exx.]**

**34Gxx Differential equations in abstract spaces [See also 58D25.]**

- G10 Linear equations [See also 47Axx, 47Bxx, 47D05.]
- G20 Nonlinear equations [See also 47Hxx.]
- G99 None of the above, but in this section

**34H05 Control problems [See also 49-XX, 93-XX.]**

**34Kxx Functional-differential and differential-difference equations, with or without deviating (or retarded) arguments**

- K05 General theory
- K10 Boundary value problems
- K15 Qualitative theory
- K20 Stability theory
- K25 Asymptotic theory
- K30 Equations in abstract spaces
- K35 Control problems
- K99 None of the above, but in this section

**35-XX PARTIAL DIFFERENTIAL EQUATIONS**

- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
- 01 Elementary exposition, textbooks
- 02 Advanced exposition (research surveys, monographs, etc.)
- 03 Historical (must also be assigned at least one classification number from Section 01)
- 04 Explicit machine computation and programs (not the theory of computation or programming)
- 06 Proceedings, conferences, etc.



- 35Axx General theory**  
 A05 General existence and uniqueness theorems  
 A07 Local existence and uniqueness theorems [See also 35Hxx, 35Sxx.]  
 A08 Fundamental solutions  
 A10 Cauchy-Kowalewski theorems  
 A15 Variational methods  
 A20 Analytic methods, singularities  
 A22 Transform methods  
 A25 Other special methods  
 A30 Geometric theory, characteristics, transformations  
 A35 Theoretical approximation to solutions  
 A40 Numerical approximation to solutions {For numerical analysis, see 65Mxx, 65Nxx, 65P05.}  
 A99 None of the above, but in this section
- 35Bxx Qualitative properties of solutions**  
 B05 Comparison theorems; oscillation, zeros and growth of solutions  
 B10 Periodic solutions  
 B15 Almost periodic solutions  
 B20 Perturbations  
 B25 Singular perturbations  
 B30 Dependence of solutions on initial and boundary data, parameters  
 B32 Bifurcation  
 B35 Stability, boundedness  
 B37 Control [See also 49-XX, 93-XX.]  
 B40 Asymptotic behavior of solutions  
 B45 A priori estimates  
 B50 Maximum principles  
 B60 Continuation and prolongation [See also 58A15, 58A17, 58Hxx.]  
 B65 Smoothness of solutions  
 B99 None of the above, but in this section
- 35Cxx Representations of solutions**  
 C05 Solutions in closed form  
 C10 Series solutions, expansion theorems  
 C15 Integral representations  
 C20 Asymptotic expansions  
 C99 None of the above, but in this section
- 35Dxx Generalized solutions**  
 D05 Existence of generalized solutions  
 D10 Regularity of generalized solutions  
 D99 None of the above, but in this section
- 35Exx Equations and systems with constant coefficients [See also 35N05.]**  
 E05 Fundamental solutions  
 E10 Convexity properties  
 E15 Initial value problems  
 E20 General theory  
 E99 None of the above, but in this section
- 35Fxx General first order equations and systems**  
 F05 Linear equations and systems, general  
 F10 Initial value problems for linear equations and systems  
 F15 Boundary value problems for linear equations and systems  
 F20 Nonlinear equations and systems, general  
 F25 Initial value problems for nonlinear equations and systems  
 F30 Boundary value problems for nonlinear equations and systems  
 F99 None of the above, but in this section
- 35Gxx General higher order equations and systems**  
 G05 Linear equations and systems, general  
 G10 Initial value problems for linear equations and systems  
 G15 Boundary value problems for linear equations and systems  
 G20 Nonlinear equations and systems, general  
 G25 Initial value problems for nonlinear equations and systems  
 G30 Boundary value problems for nonlinear equations and systems  
 G99 None of the above, but in this section
- 35H05 Hypoelliptic equations and systems [See also 58Gxx.]**
- 35Jxx Elliptic equations and systems [See also 58G05, 58G10.]**  
 J05 Laplace equation, reduced wave equation (Helmholtz), Poisson equation  
 J10 Schrödinger operator [See also 47A40.]  
 J15 Second order equations, general  
 J20 Second order equations, variational methods  
 J25 Second order equations, boundary value problems  
 J30 Higher order equations, general  
 J35 Higher order equations, variational methods  
 J40 Higher order equations, boundary value problems  
 J45 Systems, general  
 J50 Systems, variational methods  
 J55 Systems, boundary value problems  
 J60 Nonlinear equations and systems  
 J65 Nonlinear boundary value problems for linear equations and systems; boundary value problems for nonlinear equations and systems  
 J67 Boundary values of solutions  
 J70 Equations and systems of degenerate type  
 J99 None of the above, but in this section
- 35Kxx Parabolic equations and systems [See also 58G11.]**  
 K05 Heat equation  
 K10 Second order equations, general  
 K15 Second order equations, initial value problems  
 K20 Second order equations, boundary value problems  
 K22 Evolution equations (any order in the spatial derivatives) [See also 58D25.]  
 K25 Higher order equations, general  
 K30 Higher order equations, initial value problems  
 K35 Higher order equations, boundary value problems  
 K40 Systems, general  
 K45 Systems, initial value problems  
 K50 Systems, boundary value problems  
 K55 Nonlinear equations and systems  
 K60 Nonlinear boundary value problems for linear equations and systems; boundary value problems for nonlinear equations and systems  
 K65 Equations and systems of degenerate type  
 K70 Ultraparabolic, pseudoparabolic problems  
 K99 None of the above, but in this section
- 35Lxx Hyperbolic equations and systems [See also 58G16.]**  
 L05 Wave equation  
 L10 Second order equations, general  
 L15 Second order equations, initial value problems  
 L20 Second order equations, boundary value problems  
 L25 Higher order equations, general  
 L30 Higher order equations, initial value problems  
 L35 Higher order equations, boundary value problems  
 L40 First order systems, general  
 L45 First order systems, initial value problems  
 L50 First order systems, boundary value problems  
 L55 Higher order hyperbolic systems  
 L60 First order nonlinear equations and systems  
 L65 Conservation laws [See also 76-XX.]  
 L67 Shocks and singularities  
 L70 Second order nonlinear equations and systems  
 L75 Higher ( $> 2$ ) order nonlinear equations and systems  
 L80 Equations and systems of degenerate type  
 L99 None of the above, but in this section
- 35M05 Equations and systems of mixed (Tricomi, etc.) or composite type {For degenerate types, elliptic, see 35Jxx, parabolic, see 35Kxx, hyperbolic, see 35Lxx, etc.}**
- 35Nxx Overdetermined systems [See also 58G05, 58G07, 58Hxx.]**  
 N05 Constant coefficients  
 N10 Variable coefficients, general  
 N15  $\bar{\partial}$ -Neumann problem and generalizations; formal complexes [See also 32Fxx and 58G05.]  
 N99 None of the above, but in this section



- 35Pxx Spectral theory and eigenvalue problems [See also 47Axx, 47Bxx, 47F05.]**
- P05 General spectral theory
  - P10 Completeness of eigenfunctions, eigenfunction expansions
  - P15 Estimation of eigenvalues, upper and lower bounds
  - P20 Asymptotic distribution of eigenvalues and eigenfunctions
  - P25 Scattering theory [See also 47A40.]
  - P30 Nonlinear eigenvalue problems
  - P99 None of the above, but in this section
- 35Qxx Special equations and problems [See also 35J05, 35K05, 35L05.]**
- Q05 Euler-Poisson-Darboux equation and generalizations
  - Q10 Navier-Stokes equation [See also 76D05.]
  - Q15 Riemann-Hilbert problems [See also 30E25, 31A25, 31B20.]
  - Q20 Particular equations of mathematical physics (Korteweg-de Vries, Burgers, etc.)
  - Q99 None of the above, but in this section
- 35Rxx Miscellaneous topics {For equations on manifolds, see 58Gxx; for manifolds of solutions, see 58Bxx; for stochastic PDEs, see also 60H15.}**
- R05 Equations with discontinuous coefficients or data
  - R10 Difference-partial differential equations, equations with time lag
  - R15 Equations on function spaces [See also 58D25.]
  - R20 Operator equations, general [See also 34Gxx, 47A50, 47H15.]
  - R25 Improperly posed problems
  - R30 Inverse problems (undetermined coefficients, etc.)
  - R35 Free boundary problems
  - R45 Differential inequalities
  - R60 Equations and systems with randomness
  - R99 None of the above, but in this section
- 35Sxx Pseudodifferential operators [See also 47G05, 58G15.]**
- S05 General theory
  - S10 Initial value problems
  - S15 Boundary value problems
  - S99 None of the above, but in this section
- 39-XX FINITE DIFFERENCES AND FUNCTIONAL EQUATIONS**
- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
  - 01 Elementary exposition, textbooks
  - 02 Advanced exposition (research surveys, monographs, etc.)
  - 03 Historical (must also be assigned at least one classification number from Section 01)
  - 04 Explicit machine computation and programs (not the theory of computation or programming)
  - 06 Proceedings, conferences, etc.
- 39Axx Finite differences [See also 65-XX.]**
- A05 General
  - A10 Difference equations
  - A11 Stability of difference equations
  - A12 Discrete version of topics in analysis
  - A70 Difference operators [See also 47B39.]
  - A99 None of the above, but in this section
- 39Bxx Functional equations [See also 30D05.]**
- B05 General
  - B10 Equations containing iterates, equations of rank one
  - B20 Equations for one unknown function of one variable, rank greater than one
  - B30 Equations for several unknown functions of one variable, systems
  - B40 Equations for functions of several variables
  - B50 Functional equations on algebraic structures
  - B60 Matrix functional equations
  - B70 Functional equations on abstract spaces or structures
  - B99 None of the above, but in this section
- 39C05 Functional inequalities [See also 26Dxx.]**
- 40-XX SEQUENCES, SERIES, SUMMABILITY**
- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
  - 01 Elementary exposition, textbooks
  - 02 Advanced exposition (research surveys, monographs, etc.)
  - 03 Historical (must also be assigned at least one classification number from Section 01)
  - 04 Explicit machine computation and programs (not the theory of computation or programming)
  - 06 Proceedings, conferences, etc.
- 40Axx Convergence and divergence of infinite limiting processes**
- A05 Convergence and divergence of series and sequences
  - A10 Convergence and divergence of integrals
  - A15 Convergence and divergence of continued fractions [See also 30B70.]
  - A20 Convergence and divergence of infinite products
  - A25 Approximation to limiting values (summation of series, etc.) {For the Euler-Maclaurin summation formula, see 65B15.}
  - A30 Convergence and divergence of series and sequences of functions
  - A99 None of the above, but in this section
- 40B05 Multiple sequences and series (should also be assigned at least one other classification number in this section)**
- 40Cxx General summability methods**
- C05 Matrix methods
  - C10 Integral methods
  - C15 Function-theoretic methods (including power series methods and semicontinuous methods)
  - C99 None of the above, but in this section
- 40Dxx Direct theorems on summability**
- D05 General theorems
  - D09 Structure of summability fields
  - D10 Tauberian constants and oscillation limits
  - D15 Convergence factors and summability factors
  - D20 Summability and bounded fields of methods
  - D25 Inclusion and equivalence theorems
  - D99 None of the above, but in this section
- 40Exx Inversion theorems**
- E05 Tauberian theorems, general
  - E10 Growth estimates
  - E15 Lacunary inversion theorems
  - E20 Tauberian constants
  - E99 None of the above, but in this section
- 40F05 Absolute and strong summability**
- 40Gxx Special methods of summability**
- G05 Cesàro, Euler, Nörlund and Hausdorff methods
  - G10 Abel, Borel and power series methods
  - G99 None of the above, but in this section
- 40H05 Functional analytic methods in summability**
- 40J05 Summability in abstract structures [See also 43A55, 46A35, 46B15.]**
- 41-XX APPROXIMATIONS AND EXPANSIONS {For all approximation theory in the complex domain, see 30E05 and 30E10; for all trigonometric approximation and interpolation, see 42A10 and 42A15; for numerical approximation, see 65Dxx.}**
- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
  - 01 Elementary exposition, textbooks
  - 02 Advanced exposition (research surveys, monographs, etc.)
  - 03 Historical (must also be assigned at least one classification number from Section 01)
  - 04 Explicit machine computation and programs (not the theory of computation or programming)
  - 06 Proceedings, conferences, etc.
- 41A05 Interpolation [See also 42A15 and 65D05.]**
- 41A10 Approximation by polynomials {For approximation by trigonometric polynomials, see 42A10.}**
- 41A15 Spline approximation**
- 41A17 Inequalities in approximation (Bernšteĭn, Jackson, Nikol'skiĭ type inequalities)**
- 41A20 Approximation by rational functions**



- A21 Padé approximation
- A25 Rate of convergence, degree of approximation
- A27 Inverse theorems
- A28 Simultaneous approximation
- A29 Approximation with constraints
- A30 Approximation by other special function classes
- A35 Approximation by operators (in particular, by integral operators)
- A36 Approximation by positive operators
- A40 Saturation
- A44 Best constants
- A45 Approximation by arbitrary linear expressions
- A46 Approximation by arbitrary nonlinear expressions; widths and entropy
- A50 Best approximation (Čebyšev, etc.)
- A52 Uniqueness of best approximation
- A55 Approximate quadratures
- A58 Series expansions (e.g. Taylor, Lidstone series, but not Fourier series)
- A60 Asymptotic approximations, asymptotic expansions (steepest descent, etc.) [See also 30E15.]
- A63 Multidimensional problems (should also be assigned at least one other classification number in this section)
- A65 Abstract approximation theory (approximation in normed linear spaces and other abstract spaces) (should also be assigned at least one other classification number in this section)
- A99 Miscellaneous topics

#### 42-XX FOURIER ANALYSIS

- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
- 01 Elementary exposition, textbooks
- 02 Advanced exposition (research surveys, monographs, etc.)
- 03 Historical (must also be assigned at least one classification number from Section 01)
- 04 Explicit machine computation and programs (not the theory of computation or programming)
- 06 Proceedings, conferences, etc.

##### 42Axx Fourier analysis in one variable

- A05 Trigonometric polynomials, inequalities, extremal problems
- A10 Trigonometric approximation
- A15 Trigonometric interpolation
- A16 Fourier coefficients, Fourier series of functions with special properties, special Fourier series
- A20 Convergence of Fourier and trigonometric series
- A24 Summability of Fourier and trigonometric series
- A28 Absolute convergence, absolute summability
- A32 Trigonometric series of special types (positive coefficients, monotonic coefficients, etc.)
- A38 Fourier and Fourier-Stieltjes transforms and other transforms of Fourier type
- A45 Multipliers
- A50 Conjugate functions, conjugate series, singular integrals
- A55 Lacunary series of trigonometric and other functions; Riesz products
- A63 Uniqueness of trigonometric expansions, uniqueness of Fourier expansions, Riemann theory, localization
- A65 Completeness of sets of functions
- A70 Trigonometric moment problems
- A75 Classical almost periodic functions, mean periodic functions [See also 43A60.]
- A82 Positive definite functions
- A85 Convolution, factorization
- A99 None of the above, but in this section

##### 42Bxx Fourier analysis in several variables

- B05 Fourier series and coefficients
- B10 Fourier and Fourier-Stieltjes transforms and other transforms of Fourier type
- B15 Multipliers
- B20 Singular integrals (Calderón-Zygmund, etc.)
- B25 Maximal functions, Littlewood-Paley theory
- B30  $H^p$ -spaces
- B99 None of the above, but in this section

#### 42Cxx Non-trigonometric Fourier analysis

- C05 Orthogonal functions and polynomials, general theory [See also 33A65.]
- C10 Fourier series in special orthogonal functions (Legendre polynomials, Walsh functions, etc.)
- C15 Series of general orthogonal functions, generalized Fourier expansions, nonorthogonal expansions
- C20 Rearrangements and other transformations of Fourier and other orthogonal series
- C25 Uniqueness and localization for orthogonal series
- C30 Completeness of sets of functions
- C99 None of the above, but in this section

#### 43-XX ABSTRACT HARMONIC ANALYSIS (For other analysis on topological and Lie groups, see 22Exx.)

- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
- 01 Elementary exposition, textbooks
- 02 Advanced exposition (research surveys, monographs, etc.)
- 03 Historical (must also be assigned at least one classification number from Section 01)
- 04 Explicit machine computation and programs (not the theory of computation or programming)
- 06 Proceedings, conferences, etc.
- A05 Measures on groups, semigroups, etc.
- A07 Means on groups, semigroups, etc.
- A10 Measure algebras on groups, semigroups, etc.
- A15  $L^p$ -spaces and other function spaces on groups, semigroups, etc.
- A17 Analysis on ordered groups,  $H^p$ -theory
- A20  $L^1$ -algebras on groups, semigroups, etc.
- A22 Homomorphisms and multipliers of function spaces on groups, semigroups, etc.
- A25 Fourier and Fourier-Stieltjes transforms on locally compact abelian groups
- A30 Fourier and Fourier-Stieltjes transforms on nonabelian groups and on semigroups, etc.
- A32 Other transforms and operators of Fourier type
- A35 Positive definite functions on groups, semigroups, etc.
- A40 Character groups and dual objects
- A45 Spectral synthesis on groups, semigroups, etc.
- A46 Special sets (thin sets, Kronecker sets, Helson sets, Ditkin sets, Sidon sets, etc.)
- A50 Convergence of Fourier series and of inverse transforms
- A55 Summability methods on groups, semigroups, etc. [See also 40J05.]
- A60 Almost periodic functions on groups and semigroups and their generalizations (recurrent functions, distal functions, etc.); almost automorphic functions
- A65 Representations of groups, semigroups, etc. [See also 22Dxx.]
- A70 Analysis on specific locally compact abelian groups [See also 12A85.]
- A75 Analysis on specific compact groups
- A77 Analysis on general compact groups
- A80 Analysis on other specific Lie groups [See also 22E30.]
- A85 Analysis on homogeneous spaces
- A90 Spherical functions [See also 22E45, 22E46.]
- A95 Categorical methods [See also 18-XX, 46Mxx.]
- A99 Miscellaneous topics

#### 44-XX INTEGRAL TRANSFORMS, OPERATIONAL CALCULUS (For fractional derivatives and integrals, see 26A33. For numerical methods, see 65R10.)

- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
- 01 Elementary exposition, textbooks
- 02 Advanced exposition (research surveys, monographs, etc.)
- 03 Historical (must also be assigned at least one classification number from Section 01)
- 04 Explicit machine computation and programs (not the theory of computation or programming)
- 06 Proceedings, conferences, etc.
- A05 General transforms [See also 42A38.]
- A10 Laplace transform
- A15 Special transforms (Legendre, Hilbert, etc.)



- A20 Transforms of special functions
- A30 Multiple transforms
- A35 Convolution
- A40 Calculus of Mikusiński and other similar operational calculi
- A45 Classical operational calculus
- A50 Discrete operational calculus
- A99 Miscellaneous topics

#### 45-XX INTEGRAL EQUATIONS

- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
- 01 Elementary exposition, textbooks
- 02 Advanced exposition (research surveys, monographs, etc.)
- 03 Historical (must also be assigned at least one classification number from Section 01)
- 04 Explicit machine computation and programs (not the theory of computation or programming)
- 06 Proceedings, conferences, etc.
- 45A05 Linear integral equations
- 45B05 Fredholm integral equations
- 45C05 Eigenvalue problems [See also 34B25, 35Pxx, 45P05.]
- 45D05 Volterra integral equations [See also 34A10.]
- 45Exx Singular integral equations [See also 30E20, 30E25, 44A15, 44A35.]
  - E05 Integral equations with kernels of Cauchy type [See also 35J15.]
  - E10 Integral equations of the convolution type (Abel, Picard, Toeplitz and Wiener-Hopf type) [See also 47B35.]
  - E99 None of the above, but in this section
- 45Fxx Systems of linear integral equations
  - F05 Systems of nonsingular linear integral equations
  - F10 Dual, triple, etc., integral and series equations
  - F15 Systems of singular linear integral equations
  - F99 None of the above, but in this section
- 45Gxx Nonlinear integral equations [See also 47Hxx.]
  - G05 Singular nonlinear integral equations
  - G10 Other nonlinear integral equations
- 45H05 Miscellaneous special kernels [See also 44A15.]
- 45J05 Integro-ordinary differential equations
- 45K05 Integro-partial differential equations
- 45Lxx Approximation of solutions
  - L05 Theoretical approximation of solutions
  - L10 Numerical approximation of solutions {For numerical analysis, see 65R20.}
  - L99 None of the above, but in this section
- 45Mxx Qualitative behavior
  - M05 Asymptotics
  - M10 Stability theory
  - M99 None of the above, but in this section
- 45N05 Abstract integral equations, integral equations in abstract spaces
- 45P05 Integral operators [See also 47Axx, 47Bxx, 47G05.]

#### 46-XX FUNCTIONAL ANALYSIS {For manifolds modeled on topological linear spaces, see 57N20, 58Bxx.}

- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
- 01 Elementary exposition, textbooks
- 02 Advanced exposition (research surveys, monographs, etc.)
- 03 Historical (must also be assigned at least one classification number from Section 01)
- 04 Explicit machine computation and programs (not the theory of computation or programming)
- 06 Proceedings, conferences, etc.
- 46Axx Topological linear spaces
  - A05 Locally convex spaces
  - A06 Metrizable topological linear spaces and their duals (F-, DF-spaces, etc.)
  - A07 Barrelled spaces
  - A09 Bornological spaces
  - A10 Locally bounded topological linear spaces

- A12 Spaces defined by special inductive or projective limits (LF-, nuclear, Schwartz, Silva spaces, etc.) [See also 46M10, 46M40.]
- A14 Spaces defined by compactness properties (Montel spaces, etc.)
- A15 Other topological linear spaces
- A20 Duality theory
- A22 Extension and lifting of functionals and operators [See also 46M10.]
- A25 Reflexivity and semi-reflexivity
- A30 Open mappings and closed graph theorems and completeness (including  $B$ -,  $B_*$ -completeness)
- A32 Spaces of linear operators
- A35 Summability and bases
- A40 Ordered topological linear spaces, vector lattices [See also 06F20.]
- A45 Sequence spaces (including Köthe sequence spaces)
- A50 Compactness in topological linear spaces
- A55 Convexity, Choquet theory [See also 52A07.]
- A99 None of the above, but in this section
- 46Bxx Normed linear spaces and Banach spaces {For function spaces, see 46Exx.}
  - B05 Topology in terms of the norms
  - B10 Duality and reflexivity
  - B15 Summability and bases
  - B20 Geometry and structure
  - B22 Spaces with Radon-Nikodým property [See also 46G10.]
  - B25 Classical Banach spaces in the general theory
  - B30 Banach lattices
  - B99 None of the above, but in this section
- 46Cxx Inner product spaces, Hilbert spaces {For function spaces, see 46Exx.}
  - C05 Geometry and topology of the spaces
  - C10 Other properties of such spaces
  - C99 None of the above, but in this section
- 46D05 Spaces with indefinite inner product
- 46Exx Linear function spaces and their duals [See also 30H05; for function algebras, see 46J10.]
  - E05 Lattices of continuous, differentiable or analytic functions
  - E10 Topological linear spaces of continuous, differentiable or analytic functions
  - E15 Banach spaces of continuous, differentiable or analytic functions
  - E20 Hilbert spaces of continuous, differentiable or analytic functions
  - E25 Rings and algebras of continuous, differentiable or analytic functions {For Banach function algebras, see 46J10, 46J15.}
  - E27 Spaces of measures [See also 28A33.]
  - E30 Spaces of measurable functions ( $L^p$ -spaces, Orlicz spaces, Köthe function spaces, Lorentz spaces, rearrangement invariant spaces, etc.)
  - E35 Sobolev spaces and other spaces of "smooth" functions, imbedding theorems, trace theorems
  - E39 Sobolev (and similar kinds of) spaces of functions of discrete variables
  - E40 Spaces of vector- and operator-valued functions
  - E99 None of the above, but in this section
- 46Fxx Distributions, generalized functions, distribution spaces {For distribution theory on nonlinear spaces, see 58Cxx.}
  - F05 Topological linear spaces of test functions and distributions
  - F10 Operations with distributions
  - F12 Integral transforms in distribution spaces [See also 42-XX, 44-XX.]
  - F15 Hyperfunctions, analytic functionals [See also 32A25, 32A45, 32C35, 58G07.]
  - F20 Distributions as boundary values of analytic functions [See also 30Exx, 32A40.]
  - F25 Distributions on infinite-dimensional spaces [See also 58C35.]
  - F99 None of the above, but in this section



- 46Gxx Measures, integration, derivative** {For integration on infinite-dimensional spaces, see 28C20; for nonlinear functional analysis, see 58-XX, especially 58Cxx.}
- G05 Derivatives
  - G10 Vector-valued measures and integration [See also 28B05, 46B22.]
  - G15 Lifting theory [See also 28A51.]
  - G20 Infinite-dimensional holomorphy (should also be assigned at least one classification number from Section 32) [See also 58B12, 58C10.]
  - G99 None of the above, but in this section
- 46Hxx Topological algebras, normed rings and algebras, Banach algebras** {For group algebras, convolution algebras and measure algebras, see 43-XX.}
- H05 General theory
  - H10 Ideals and subalgebras
  - H15 Representations
  - H20 Structure, classification
  - H25 Normed modules and Banach modules, topological modules (if not placed in 13-XX or 16-XX)
  - H30 Functional calculus [See also 47A60.]
  - H99 None of the above, but in this section
- 46Jxx Commutative Banach algebras and commutative topological algebras**
- J05 General theory
  - J10 Banach algebras of continuous functions, function algebras
  - J15 Banach algebras of differentiable or analytic functions,  $H^p$ -spaces [See also 30A98, 32A35, 32E25, 42B30.]
  - J20 Ideals, maximal ideals, boundaries
  - J25 Representations
  - J30 Subalgebras
  - J35 Structure, classification
  - J99 None of the above, but in this section
- 46Kxx Rings and algebras with an involution**
- K05 General theory
  - K10 Representations
  - K15 Hilbert algebras
  - K99 None of the above, but in this section
- 46Lxx  $C^*$ -algebras and von Neumann ( $W^*$ -) algebras** [See also 22D25.]
- L05  $C^*$ -algebras, general theory
  - L10 von Neumann algebras, general theory
  - L30 States
  - L35 Classifications, factors
  - L40 Automorphisms
  - L45 Decomposition theory
  - L50 Noncommutative integration, noncommutative probability
  - L55 Noncommutative dynamical systems [See also 28Dxx.]
  - L60 Applications to physics
  - L99 None of the above, but in this section
- 46Mxx Categorical methods** [See also 18-XX.]
- M05 Tensor products
  - M10 Projective and injective objects
  - M15 Functors
  - M20 Methods of algebraic topology (cohomology, sheaf and bundle theory, etc.) [See also 14F05, 18Fxx, 55Rxx.]
  - M35 Abstract interpolation of topological vector spaces
  - M40 Inductive and projective limits [See also 46A12.]
  - M99 None of the above, but in this section
- 46N05 Miscellaneous applications of functional analysis**
- 46P05 Functional analysis over fields other than  $\mathbb{R}$  or  $\mathbb{C}$ ; non-Archimedean functional analysis** [See also 12J25, 32E27.]
- 47-XX OPERATOR THEORY**
- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
  - 01 Elementary exposition, textbooks
  - 02 Advanced exposition (research surveys, monographs, etc.)
  - 03 Historical (must also be assigned at least one classification number from Section 01)
  - 04 Explicit machine computation and programs (not the theory of computation or programming)
  - 06 Proceedings, conferences, etc.
- 47Axx Single linear operators: general theory**
- A05 General (adjoints, conjugates, products, inverses, domains, ranges, etc.)
  - A10 Spectrum, resolvent
  - A12 Numerical range
  - A15 Invariant subspaces
  - A20 Dilations, extensions, compressions
  - A25 Spectral sets
  - A30 Norms (inequalities, more than one norm, etc.)
  - A35 Ergodic theory [See also 28Dxx.]
  - A40 Scattering theory [See also 34B25, 35P25, 47Dxx.]
  - A45 Canonical models for contractions and nonselfadjoint operators
  - A50 Equations involving linear operators, with vector unknowns
  - A53 Fredholm operators
  - A55 Perturbation theory
  - A60 Functional calculus
  - A62 Equations involving linear operators, with operator unknowns
  - A65 Structure theory
  - A66 (Non)quasitriangular, (non)quasidiagonal operators
  - A67 Representation theory
  - A68 Factorization theory
  - A70 Eigenfunction expansions, rigged Hilbert spaces; eigenvalue problems in general [See also 49Gxx.]
  - A99 None of the above, but in this section
- 47Bxx Single linear operators: special classes of operators**
- B05 Compact operators, Riesz operators
  - B10 Hilbert-Schmidt operators, trace class operators, nuclear operators,  $p$ -summing operators, etc.
  - B15 Hermitian and normal operators (spectral measures, functional calculus, etc.)
  - B20 Subnormal operators, hyponormal operators, etc.
  - B25 Symmetric and selfadjoint operators (unbounded)
  - B35 Toeplitz operators, Wiener-Hopf operators [See also 45P05, 47G05 for other integral operators.]
  - B37 Operators on special spaces (weighted shifts, operators on sequence spaces, etc.)
  - B38 Operators on function spaces
  - B39 Difference operators [See also 39A70.]
  - B40 Spectral operators, decomposable operators, etc.
  - B44 Accretive operators, dissipative operators, etc.
  - B47 Commutators, derivations
  - B50 Operators on a space with an indefinite metric
  - B55 Operators on ordered spaces
  - B99 None of the above, but in this section
- 47Cxx Single linear operators as elements of algebraic systems**
- C05 Operators in algebras
  - C10 Operators in  $*$ -algebras
  - C15 Operators in  $C^*$ - or von Neumann algebras
  - C99 None of the above, but in this section
- 47Dxx Algebraic systems of linear operators** [See also 46Lxx.]
- D05 Semigroups of operators (For nonlinear operators, see 47H20; see also 20M20.)
  - D07 Markov semigroups (For Markov processes, see 60Jxx.)
  - D10 Groups of operators
  - D15 Linear spaces of operators
  - D20 Convex sets and cones of operators
  - D25 Operator algebras and ideals, on Hilbert space
  - D30 Operator algebras and ideals, on Banach spaces and other linear topological spaces
  - D35 Dual spaces of operator algebras and topological groups
  - D40 Algebras of unbounded operators
  - D45 Applications to physics
  - D99 None of the above, but in this section
- 47E05 Ordinary differential operators** [See also 34B25, 58Fxx.]
- 47F05 Partial differential operators** [See also 35Pxx, 58Gxx.]



- 47G05** Integral, integro-differential, and pseudodifferential operators [See also 35Sxx, 45P05, 58Gxx.]
- 47Hxx** Nonlinear operators (For global and geometric aspects, see 58-XX, especially 58Cxx.)
- H05 Monotone operators
  - H06 Accretive operators, dissipative operators, etc.
  - H07 Monotone and positive operators on ordered Banach spaces or other ordered topological vector spaces
  - H09 Nonexpansive mappings, ultimately compact mappings,  $K$ -set contractions, etc.
  - H10 Fixed-point theorems [See also 34C29, 54H25, 55M20, 58C30.]
  - H12 Spectral theory of nonlinear operators
  - H15 Equations involving nonlinear operators [See also 58E07 for abstract bifurcation theory.]
  - H17 Methods for solving equations involving nonlinear operators (For numerical analysis, see 65J15.)
  - H20 Semigroups of nonlinear operators [See also 58D07.]
  - H99 None of the above, but in this section
- 49-XX** CALCULUS OF VARIATIONS AND OPTIMAL CONTROL; OPTIMIZATION [See also 34H05, 65Kxx, 90Cxx, 93-XX.]
- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
  - 01 Elementary exposition, textbooks
  - 02 Advanced exposition (research surveys, monographs, etc.)
  - 03 Historical (must also be assigned at least one classification number from Section 01)
  - 04 Explicit machine computation and programs (not the theory of computation or programming)
  - 06 Proceedings, conferences, etc.
- 49Axx** Existence theory for optimal solutions
- A05 Free problems in one independent variable
  - A10 Problems involving ordinary differential equations, optimal control
  - A21 Free problems in two or more independent variables
  - A22 Problems involving partial differential equations, optimal control
  - A27 Problems in abstract spaces
  - A29 Variational inequalities
  - A34 Problems involving functional relations other than differential equations
  - A36 Optimal solutions belonging to restricted classes (bang-bang controls, etc.)
  - A40 Minimax problems
  - A45 Game theory; pursuit and evasion [See also 90Dxx.]
  - A50 Topology of solutions, weak and strong minima, semi-continuity, convexity, orientor fields
  - A60 Optimal stochastic control [See also 93Exx.]
  - A99 None of the above, but in this section
- 49Bxx** Necessary conditions and sufficient conditions for optimality
- B05 Free problems in one independent variable
  - B10 Problems involving ordinary differential equations, optimal control
  - B21 Free problems in two or more independent variables
  - B22 Problems involving partial differential equations, optimal control
  - B27 Problems in abstract spaces
  - B34 Problems involving functional relations other than differential equations
  - B36 Optimal solutions belonging to restricted classes
  - B40 Minimax problems
  - B50 Sensitivity of optimal solutions in the presence of perturbations
  - B60 Optimal stochastic control [See also 93Exx.]
  - B99 None of the above, but in this section
- 49Cxx** Carathéodory, Hamilton-Jacobi theories, including dynamic programming [See also 90C39.]
- C05 Free problems and problems involving ordinary differential equations
- C10 Free problems and problems involving partial differential equations
  - C15 Problems in abstract spaces or involving functional relations other than differential equations
  - C20 Dynamic programming method
  - C99 None of the above, but in this section
- 49Dxx** Methods of successive approximations (For discrete problems, see 90Cxx; see also 65Kxx.)
- D05 Methods based on necessary conditions
  - D07 Gradient methods
  - D10 Methods of steepest descent type
  - D15 Methods of Newton-Raphson, Galerkin and Ritz types
  - D20 Methods of relaxation type
  - D25 Finite difference methods
  - D27 Decomposition methods
  - D29 Multiplier methods
  - D30 Other methods, not based on necessary conditions (penalty function, etc.)
  - D35 Methods of linear programming type
  - D37 Nonlinear programming
  - D39 Semi-infinite programming
  - D40 Methods of quadratic programming type
  - D45 Methods of convex programming type
  - D49 Geometric programming
  - D50 Periodic optimization
  - D99 None of the above, but in this section
- 49Exx** Controllability and geometry of control problems
- E05 General dependence on controls
  - E10 Orientor fields (contingency equations)
  - E15 Attainable sets, controllability
  - E20 Interrelations between stability problems and optimization problems
  - E25 Effect of perturbations on controllability
  - E30 Relations between controllability and optimal solutions
  - E99 None of the above, but in this section
- 49Fxx** Manifolds [See also 58Exx.]
- F05 Exterior differential forms, invariant integrals (Cartan theory) [See mainly 58A15.]
  - F10 Minimal surfaces [See mainly 53A10, also 58E12.]
  - F15 Morse theory in Hilbert and other spaces [See also 57R27, 58Exx.]
  - F20 Geometric measure and integration theory, integral and normal currents, flat chains and cochains, varifolds [See also 28A75, 32C30, 58A25, 58C35.]
  - F22 Existence and structure of solutions to variational problems in geometric measure-theoretic setting
  - F25 Surface area; Weierstrass and Burkil integrals, subadditive set functions
  - F99 None of the above, but in this section
- 49Gxx** Variational methods for eigenvalues [See also 47A70.]
- G05 Variational approach to eigenvalues
  - G10 Rayleigh-Ritz methods
  - G15 Weinstein and Aronszajn methods, intermediate problems
  - G20 Linear operators in Hilbert spaces
  - G99 None of the above, but in this section
- 49H05** Variational principles of physics [See also 70-XX, 81-XX.]
- 51-XX** GEOMETRY (For algebraic geometry, see 14-XX.)
- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
  - 01 Elementary exposition, textbooks
  - 02 Advanced exposition (research surveys, monographs, etc.)
  - 03 Historical (must also be assigned at least one classification number from Section 01)
  - 04 Explicit machine computation and programs (not the theory of computation or programming)
  - 06 Proceedings, conferences, etc.
- 51Axx** Linear incidence geometry
- A05 General theory and projective geometries
  - A10 Homomorphism, automorphism and dualities
  - A15 Structures with parallelism
  - A20 Configuration theorems



- A25 Algebraization [See also 12Kxx, 20N10.]
  - A30 Desarguesian and Pappian geometries
  - A35 Non-Desarguesian affine and projective planes
  - A40 Translation planes and spreads
  - A45 Incidence structures imbeddable into projective geometries
  - A99 None of the above, but in this section
  - 51Bxx Nonlinear incidence geometry**
    - B05 General theory
    - B10 Möbius geometries
    - B15 Laguerre geometries
    - B20 Minkowski geometries
    - B25 Lie geometries
    - B99 None of the above, but in this section
  - 51C05 Ring geometry (Hjelmslev, Barbilian, etc.)**
  - 51Dxx Geometric closure systems**
    - D05 Abstract (Maeda) geometries
    - D10 Abstract geometries with exchange axiom
    - D15 Abstract geometries with parallelism
    - D20 Combinatorial geometries [See also 05B25.]
    - D25 Lattices of subspaces [See also 05B35.]
    - D30 Continuous geometries and related topics
    - D99 None of the above, but in this section
  - 51Exx Finite geometry**
    - E05 General block designs [See also 05B05.]
    - E10 Steiner systems
    - E15 Affine and projective planes
    - E20 Combinatorial structures in finite projective spaces [See also 05Bxx.]
    - E25 Finite nonlinear geometries
    - E30 Other finite incidence structures [See also 05B30.]
    - E99 None of the above, but in this section
  - 51Fxx Metric geometry**
    - F05 Absolute planes
    - F10 Absolute spaces
    - F15 Reflection groups, reflection geometries [See also 20H10, 20H15.]
    - F20 Congruence and orthogonality [See also 20H05.]
    - F25 Orthogonal and unitary groups [See also 20H05.]
    - F99 None of the above, but in this section
  - 51G05 Ordered geometries (ordered incidence structures, etc.)**
  - 51Hxx Topological geometry**
    - H05 General theory
    - H10 Topological linear incidence structures
    - H15 Topological nonlinear incidence structures
    - H20 Topological geometries on manifolds [See also 57-XX.]
    - H25 Geometries with differentiable structure [See also 53Cxx, 53C70.]
    - H30 Geometries with algebraic manifold structure [See also 14-XX.]
    - H99 None of the above, but in this section
  - 51Jxx Incidence groups**
    - J05 General theory
    - J10 Projective incidence groups
    - J15 Kinematic spaces
    - J20 Representation by near-fields and near-algebras [See also 12K05, 16A76.]
    - J99 None of the above, but in this section
  - 51Kxx Distance geometry**
    - K05 General theory
    - K10 Synthetic differential geometry
    - K99 None of the above, but in this section
  - 51Lxx Geometric order structures [See also 53C75.]**
    - L05 Geometry of orders of nondifferentiable curves
    - L10 Directly differentiable curves
    - L15  $n$ -vertex theorems via direct methods
    - L20 Geometry of orders of surfaces
    - L99 None of the above, but in this section
  - 51Mxx Real and complex geometry**
    - M05 Euclidean geometries
    - M10 Hyperbolic and elliptic geometries
    - M15 Geometric constructions
    - M20 Polyhedra and polytopes; regular figures, division of spaces [See also 51F15.]
    - M25 Length, area and volume [See also 26B15.]
    - M30 Line geometries and their generalizations
    - M35 Synthetic treatment of fundamental manifolds in projective geometries (Grassmannians, Veronesians and their generalizations) [See also 14M15.]
    - M99 None of the above, but in this section
  - 51Nxx Analytic and descriptive geometry**
    - N05 Descriptive geometry
    - N10 Affine analytic geometry
    - N15 Projective analytic geometry
    - N20 Euclidean analytic geometry
    - N25 Analytic geometry with other transformation groups
    - N30 Geometry of classical groups [See also 20Gxx, 14Lxx.]
    - N35 Questions of classical algebraic geometry [See also 14Nxx.]
    - N99 None of the above, but in this section
- 52-XX CONVEX SETS AND RELATED GEOMETRIC TOPICS**
- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
  - 01 Elementary exposition, textbooks
  - 02 Advanced exposition (research surveys, monographs, etc.)
  - 03 Historical (must also be assigned at least one classification number from Section 01)
  - 04 Explicit machine computation and programs (not the theory of computation or programming)
  - 06 Proceedings, conferences, etc.
  - A01 Axiomatic and generalized convexity
  - A05 Convex sets without dimension restrictions
  - A07 Convex sets in topological vector spaces [See also 46A55.]
  - A10 Convex sets in 2 dimensions
  - A15 Convex sets in 3 dimensions
  - A20 Convex sets in  $n$  dimensions
  - A22 Random convex sets and integral geometry [See also 53C65, 60D05.]
  - A25 Polyhedra and polytopes
  - A30 Invariants of convex sets (star-shaped,  $(m, n)$ -convex, etc.)
  - A35 Helly type theorems
  - A37 Other problems of combinatorial geometry
  - A40 Inequalities and extremum problems
  - A43 Lattices and convex bodies [See also 10E05.]
  - A45 Packing, covering, tiling [See also 05B40, 05B45, 10E30, 51-XX.]
  - A99 Miscellaneous topics
- 53-XX DIFFERENTIAL GEOMETRY {For differential topology, see 57Rxx. For foundational questions of differentiable manifolds, see 58Axx.}**
- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
  - 01 Elementary exposition, textbooks
  - 02 Advanced exposition (research surveys, monographs, etc.)
  - 03 Historical (must also be assigned at least one classification number from Section 01)
  - 04 Explicit machine computation and programs (not the theory of computation or programming)
  - 06 Proceedings, conferences, etc.
  - 53Axx Classical differential geometry**
    - A04 Curves in Euclidean space
    - A05 Surfaces in Euclidean space
    - A07 Higher-dimension and -codimension surfaces in Euclidean  $n$ -space
    - A10 Minimal surfaces, surfaces with prescribed mean curvature [See also 49F10, 53C42.]
    - A15 Affine differential geometry
    - A17 Kinematics
    - A20 Projective differential geometry
    - A25 Differential line geometry
    - A30 Conformal differential geometry
    - A35 Non-Euclidean differential geometry
    - A40 Other special differential geometries
    - A45 Vector and tensor analysis



- A50 Spinor analysis
- A55 Differential invariants (local theory), geometric objects
- A60 Geometry of webs [See also 14C21, 20N05.]
- A99 None of the above, but in this section
- 53Bxx Local differential geometry**
  - B05 Linear and affine connections
  - B10 Projective connections
  - B15 Other connections
  - B20 Local Riemannian geometry
  - B21 Methods of Riemannian geometry
  - B25 Local submanifolds [See also 53C40.]
  - B30 Lorentz metrics, indefinite metrics
  - B35 Hermitian and Kählerian structures [See also 32Cxx.]
  - B40 Finsler spaces and generalizations (areal metrics)
  - B50 Applications to physics
  - B99 None of the above, but in this section
- 53Cxx Global differential geometry [See also 51H25, 58–XX; for related bundle theory, see 55Rxx, 57Rxx.]**
  - C05 Connections
  - C10  $G$ -structures
  - C15 Almost complex, contact, symplectic, almost product structures, etc.
  - C20 Riemannian manifolds, including pinching [See also 31C12, 58B20.]
  - C21 Methods of Riemannian geometry
  - C22 Geodesics [See also 58E10.]
  - C25 Special Riemannian manifolds (Einstein, Sasakian, etc.)
  - C30 Homogeneous manifolds [See also 14M15, 14M17, 32M10, 57T15.]
  - C35 Symmetric spaces [See also 32M15, 57T15.]
  - C40 Submanifolds [See also 53B25.]
  - C42 Immersions (minimal, prescribed curvature, tight, etc.) [See also 49F10, 53A10, 57R40, 57R42.]
  - C45 Global surface theory (convex surfaces à la A. D. Aleksandrov)
  - C50 Lorentz manifolds, manifolds with indefinite metrics
  - C55 Hermitian and Kählerian manifolds [See also 32Cxx.]
  - C60 Finsler spaces and generalizations (areal metrics) [See also 58B20.]
  - C65 Integral geometry, differential forms, currents, etc. [See also 52A22, 58Axx.]
  - C70 Direct methods ( $G$ -spaces of Busemann, etc.)
  - C75 Geometric orders, order geometry [See also 51Lxx.]
  - C80 Applications to physics
  - C99 None of the above, but in this section
- 54–XX GENERAL TOPOLOGY {For the topology of manifolds of all dimensions, see 57Nxx.}**
  - 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
  - 01 Elementary exposition, textbooks
  - 02 Advanced exposition (research surveys, monographs, etc.)
  - 03 Historical (must also be assigned at least one classification number from Section 01)
  - 04 Explicit machine computation and programs (not the theory of computation or programming)
  - 06 Proceedings, conferences, etc.
- 54Axx Generalities**
  - A05 Topological spaces and generalizations (closure spaces, etc.)
  - A10 Change of topology, comparison of topologies
  - A15 Syntopogeneous structures
  - A20 Convergence (general theory) and limits
  - A25 Cardinality properties (discrete subsets, weight, etc.), ultrafilters, etc. [See also 03Exx, 04A30.]
  - A35 Consistency and independence results [See also 03E35.]
  - A40 Fuzzy topology [See also 03E72.]
  - A99 None of the above, but in this section
- 54Bxx Basic constructions**
  - B05 Subspaces
  - B10 Product spaces
  - B15 Quotient spaces, decompositions
  - B17 Adjunction spaces and similar constructions
  - B20 Hyperspaces
- 54Cxx Maps and general types of spaces defined by maps**
  - C05 Continuous maps
  - C08 Connectivity maps, semicontinuous maps, etc.
  - C10 Special maps: open, closed, perfect, almost open, light, etc.
  - C15 Retraction
  - C20 Extension
  - C25 Imbedding
  - C30 Real-valued functions [See also 26–XX.]
  - C35 Function spaces [See also 58D15.]
  - C40  $C(X)$ ; algebraic techniques (ideals, etc.) [See also 46J10.]
  - C45  $C$ - and  $C^*$ -imbedding
  - C50 Zero sets, Baire sets and functions [See also 26A21.]
  - C55 Absolute neighborhood extensor, absolute extensor, absolute neighborhood retract (ANR), absolute retract spaces (general properties) [See also 54F40, 55M15.]
  - C56 Shape theory [See mainly 55P55, 57N25.]
  - C60 Set-valued maps [See also 26E25, 28B20.]
  - C65 Selections [See also 28B20.]
  - C70 Entropy
  - C99 None of the above, but in this section
- 54Dxx Fairly general properties**
  - D05 Connected and locally connected spaces (general aspects)
  - D10 Separation axioms,  $T_0 - T_3$
  - D15 Higher separation axioms (completely regular, normal, perfectly or collectionwise normal, etc.)
  - D18 Paracompactness, pointwise paracompactness, etc.
  - D20 Covering properties: Lindelöf,  $(m, n)$ -compact, etc.
  - D25 “ $P$ -minimal” and “ $P$ -closed” spaces
  - D30 Compact spaces and generalizations
  - D35 Compactifications, etc.
  - D40 Remainders
  - D45 Local compactness,  $\sigma$ -compactness
  - D50  $k$ -spaces
  - D55 Sequential spaces
  - D60 Realcompactness and realcompactification
  - D99 None of the above, but in this section
- 54Exx Spaces with richer structures**
  - E05 Proximity structures and generalizations
  - E10  $p$ -maps
  - E15 Uniform structures and generalizations
  - E17 Nearness spaces
  - E18  $p$ -spaces,  $M$ -spaces,  $\sigma$ -spaces, etc.
  - E20 Stratifiable spaces, cosmic spaces, etc.
  - E25 Semimetric spaces
  - E30 Moore spaces
  - E35 Metric spaces, metrizability
  - E40 Isometries, contractions, expansions
  - E45 Compact (locally compact) metric spaces
  - E50 Complete metric spaces
  - E52 Completions, Baire category
  - E55 Bitopologies
  - E60 CW-complexes, triangulable spaces
  - E65 Countability conditions, separability
  - E99 None of the above, but in this section
- 54Fxx Special properties**
  - F05 Ordered topological spaces, partially ordered spaces [See also 06B30, 06F30.]
  - F15 Continua and generalizations
  - F20 Special types of continua
  - F25 Peano spaces and generalizations
  - F30 Cyclic elements
  - F35 Higher dimensional local connectedness [See also 55Mxx, 55Nxx.]
  - F40 Compact (locally compact) absolute neighborhood retracts
  - F43 Shape theory [See mainly 55P55, 57N25.]
  - F45 Dimension theory [See also 55M10.]
  - F50 Spaces of dimension  $\leq 1$ ; curves, dendrites [See also 26A03.]
  - F55 Unicoherence, multicoherence



- F60 Maps into  $S_n$
- F62 Periodic maps
- F65 Topological characterizations of particular spaces
- F99 None of the above, but in this section

**54Gxx Peculiar spaces**

- G05 Extremely disconnected spaces,  $F$ -spaces, etc.
- G10  $P$ -spaces
- G15 Pathological spaces
- G20 Counterexamples
- G99 None of the above, but in this section

**54Hxx Connections with other structures, applications**

- H05 Descriptive set theory (topological aspects of Borel, analytic, projective, etc. sets) [See also 03E15, 04A15, 26A21, 28A05.]
- H10 Topological representations of algebraic systems [See also 22-XX.]
- H12 Topological lattices, etc. [See also 06B30, 06F30.]
- H13 Topological fields, rings, etc. {For algebraic aspects, see 12Jxx, 13Jxx, 16A80.}
- H15 Transformation groups and semigroups [See also 20M20, 22-XX, 57Sxx.]
- H20 Topological dynamics [See also 28Dxx, 34C35, 58Fxx.]
- H25 Fixed-point and coincidence theorems [See also 47H10, 55M20.]
- H99 None of the above, but in this section

**54J05 Nonstandard topology [See also 03Hxx.]****55-XX ALGEBRAIC TOPOLOGY**

- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
- 01 Elementary exposition, textbooks
- 02 Advanced exposition (research surveys, monographs, etc.)
- 03 Historical (must also be assigned at least one classification number from Section 01)
- 04 Explicit machine computation and programs (not the theory of computation or programming)
- 06 Proceedings, conferences, etc.

**55Mxx Classical topics {For the topology of Euclidean spaces and manifolds, see 57N05, 57N10, 57N15.}**

- M05 Duality
- M10 Dimension theory [See also 54F45.]
- M15 Absolute neighborhood retracts [See also 54C55, 54F40.]
- M20 Fixed points and coincidences [See also 54H25.]
- M25 Degree, winding number
- M30 Ljusternik-Schnirelman category of a space
- M35 Finite groups of transformations (including Smith theory) [See also 57S17.]
- M99 None of the above, but in this section

**55Nxx Homology and cohomology theories [See also 57Txx.]**

- N05 Čech types
- N07 Steenrod-Sitnikov homologies
- N10 Singular theory
- N15  $K$ -theory {For algebraic  $K$ -theory, see 18F25.}
- N20 Generalized (extraordinary) homology and cohomology theories
- N22 Bordism and cobordism theories, formal group laws [See also 14L05, 57R75, 57R77, 57R85, 57R90.]
- N25 Homology with local coefficients, equivariant cohomology
- N30 Sheaf cohomology [See also 18F20, 32C35, 32L10.]
- N35 Other homology theories
- N40 Axioms for homology theory and uniqueness theorems
- N45 Products and intersections
- N99 None of the above, but in this section

**55Pxx Homotopy theory {For simple homotopy type, see 57Q10.}**

- P05 Homotopy extension properties, cofibrations
- P10 Homotopy equivalences
- P15 Classification of homotopy type
- P20 Eilenberg-MacLane spaces
- P25 Spanier-Whitehead duality
- P30 Eckmann-Hilton duality
- P35 Loop spaces
- P40 Suspensions

- P42 Stable homotopy theory, spectra
- P45  $H$ -spaces and duals
- P47 Infinite loop spaces
- P50 Category and cocategory, etc.
- P55 Shape theory [See also 54C56, 54F43, 55Q07.]
- P60 Localization and completion
- P62 Rational homotopy theory
- P65 Homotopy functors
- P99 None of the above, but in this section

**55Qxx Homotopy groups**

- Q05 Homotopy groups, general; sets of homotopy classes
- Q07 Shape groups
- Q10 Stable homotopy groups
- Q15 Whitehead products and generalizations
- Q20 Homotopy groups of wedges, joins, and simple spaces
- Q25 Hopf invariants
- Q30 Homotopy groups of triads,  $n$ -ads
- Q35 Operations in homotopy groups
- Q40 Homotopy groups of spheres
- Q45 Stable homotopy of spheres
- Q50 The  $J$ -morphism
- Q52 Homotopy groups of special spaces
- Q55 Cohomotopy groups
- Q70 Homotopy groups of special types [See also 55N05, 55N07.]
- Q99 None of the above, but in this section

**55Rxx Fiber spaces and bundles [See also 18F15, 32Lxx, 46M20, 57R20, 57R22, 57R25.]**

- R05 Fiber spaces
- R10 Fiber bundles
- R15 Classification
- R20 Spectral sequences and homology of fiber spaces [See also 55Txx.]
- R25 Sphere bundles and vector space bundles
- R35 Classifying spaces of groups and  $H$ -spaces
- R40 Homology of classifying spaces, characteristic classes [See also 57Txx, 57R20.]
- R45 Homology and homotopy of BO and BU; Bott periodicity
- R50 Stable classes of vector space bundles,  $K$ -theory {For algebraic  $K$ -theory, see 18F25.}
- R55 Fiberings with singularities
- R60 Microbundles and block bundles [See also 57N55, 57Q50.]
- R65 Generalizations of fiber spaces and bundles
- R99 None of the above, but in this section

**55Sxx Operations and obstructions**

- S05 Primary cohomology operations
- S10 Steenrod algebra
- S12 Dyer-Lashof operations
- S15 Symmetric products, cyclic products
- S20 Secondary and higher cohomology operations
- S25  $K$ -theory operations and generalized cohomology operations
- S30 Massey products
- S35 Obstruction theory
- S36 Extension and compression of mappings
- S37 Classification of mappings
- S40 Sectioning fiber spaces and bundles
- S45 Postnikov systems,  $k$ -invariants
- S99 None of the above, but in this section

**55Txx Spectral sequences [See also 18G40, 55R20.]**

- T05 General
- T10 Serre spectral sequences
- T15 Adams spectral sequences
- T20 Eilenberg-Moore spectral sequences [See also 57T35.]
- T25 Generalized cohomology
- T99 None of the above, but in this section

**55Uxx Applied homological algebra and category theory [See also 18Gxx.]**

- U05 Abstract complexes
- U10 Semisimplicial complexes
- U15 Chain complexes
- U20 Universal coefficient theorems, Bockstein operator



- U25 Homology of a product, Künneth formula
- U30 Duality
- U35 Abstract homotopy theory
- U40 Topological categories
- U99 None of the above, but in this section

### 57-XX MANIFOLDS AND CELL COMPLEXES {For complex manifolds, see 32C10.}

- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
- 01 Elementary exposition, textbooks
- 02 Advanced exposition (research surveys, monographs, etc.)
- 03 Historical (must also be assigned at least one classification number from Section 01)
- 04 Explicit machine computation and programs (not the theory of computation or programming)
- 06 Proceedings, conferences, etc.

#### 57Mxx Low-dimensional topology (old 55Axx)

- M05 Fundamental group, presentations, free differential calculus
- M10 Covering spaces
- M12 Special coverings, e.g. branched
- M15 Relations with graph theory [See also 05Cxx.]
- M20 Two-dimensional complexes
- M25 Knots and links in  $S^3$  {For higher dimensions, see 57Q45.}
- M30 Wild knots and surfaces, etc., wild imbeddings
- M35 Dehn's Lemma, sphere theorem, loop theorem, asphericity
- M40 Characterizations of  $E^3$  and  $S^3$  (Poincaré conjecture) [See also 57N12.]
- M99 None of the above, but in this section

#### 57Nxx Topological manifolds

- N05 Topology of  $E^2$ , 2-manifolds
- N10 Topology of general 3-manifolds [See also 57Mxx.]
- N12 Topology of  $E^3$  and  $S^3$  [See also 57M40.]
- N15 Topology of  $E^n$ ,  $n$ -manifolds ( $3 < n < \infty$ )
- N17 Topology of topological vector spaces
- N20 Topology of infinite-dimensional manifolds [See also 58Bxx.]
- N25 Shapes [See also 54C56, 54F43, 55P55, 55Q07.]
- N30 Engulfing
- N35 Imbeddings and immersions
- N37 Isotopy and pseudo-isotopy
- N40 Neighborhoods of submanifolds
- N45 Flatness and tameness
- N50  $S^{n-1} \subset E^n$ , Schoenflies problem
- N55 Microbundles and block bundles [See also 55R60, 57Q50.]
- N60 Cellularity
- N65 Algebraic topology of manifolds
- N70 Cobordism and concordance
- N75 General position and transversality
- N80 Stratifications
- N99 None of the above, but in this section

#### 57Pxx Generalized manifolds [See also 18F15.]

- P05 Local properties
- P10 Poincaré duality spaces
- P99 None of the above, but in this section

#### 57Qxx PL-topology

- Q05 The general topology of complexes
- Q10 Simple homotopy type, Whitehead torsion, Reidemeister-Franz torsion, etc.
- Q15 Triangulating manifolds
- Q20 Cobordism
- Q25 Comparison of PL-structures: classification, Hauptvermutung
- Q30 Engulfing
- Q35 Imbeddings and immersions
- Q37 Isotopy
- Q40 Regular neighborhoods
- Q45 Knots and links (in high dimensions) {For the low-dimensional case, see 57M25.}
- Q50 Microbundles and block bundles [See also 55R60, 57N55.]
- Q55 Approximations

- Q60 Cobordism and concordance
- Q65 General position and transversality
- Q99 None of the above, but in this section

### 57Rxx Differential topology {For foundational questions of differentiable manifolds, see 58Axx; for infinite-dimensional manifolds, see 58Bxx.}

- R05 Triangulating
- R10 Smoothing
- R12 Smooth approximations
- R15 Specialized structures on manifolds (spin manifolds, frame manifolds, etc.)
- R20 Characteristic classes and numbers
- R22 Topology of vector bundles and fiber bundles [See also 55Rxx.]
- R25 Vector fields, frame fields, etc.
- R27 Controllability of vector fields on  $C^\infty$  and real-analytic manifolds [See also 49E15, 49F15.]
- R30 Foliations; geometric theory
- R32 Classifying spaces for foliations; Gel'fand-Fuks cohomology
- R35 Differentiable mappings
- R40 Imbeddings
- R42 Immersions
- R45 Singularities of differentiable mappings
- R50 Diffeomorphisms
- R52 Isotopy
- R55 Differentiable structures
- R60 Homotopy spheres, Poincaré conjecture
- R65 Surgery and handlebodies
- R67 Surgery obstructions, Wall groups [See also 18F25.]
- R70 Critical points and critical submanifolds
- R75 O- and SO-cobordism
- R77 Complex cobordism (U- and SU-cobordism) [See also 55N22.]
- R80  $h$ - and  $s$ -cobordism
- R85 Equivariant cobordism
- R90 Other types of cobordism [See 55N22.]
- R95 Realizing cycles by submanifolds
- R99 None of the above, but in this section

### 57Sxx Topological transformation groups [See also 20F34, 22-XX, 54H15, 58D05.]

- S05 Topological properties of groups of homeomorphisms
- S10 Compact groups of homeomorphisms
- S15 Compact Lie groups of differentiable transformations
- S17 Finite transformation groups
- S20 Noncompact Lie groups of transformations
- S25 Groups acting on specific manifolds
- S30 Discontinuous groups of transformations
- S99 None of the above, but in this section

### 57Txx Homology and homotopy of topological groups and related structures

- T05 Hopf algebras [See also 16A24.]
- T10 Homology and cohomology of Lie groups
- T15 Homology and cohomology of homogeneous spaces of Lie groups
- T20 Homotopy groups of topological groups and homogeneous spaces
- T25 Homology and cohomology of  $H$ -spaces
- T30 Bar and cobar constructions [See also 18G55, 55Uxx.]
- T35 Applications of Eilenberg-Moore spectral sequences [See also 55R20, 55T20.]
- T99 None of the above, but in this section

### 58-XX GLOBAL ANALYSIS, ANALYSIS ON MANIFOLDS [See also 32Cxx, 32Fxx, 46-XX, 47Hxx, 53Cxx; for geometric integration theory, see 49F20, 49F22.]

- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
- 01 Elementary exposition, textbooks
- 02 Advanced exposition (research surveys, monographs, etc.)
- 03 Historical (must also be assigned at least one classification number from Section 01)



- 04 Explicit machine computation and programs (not the theory of computation or programming)
- 06 Proceedings, conferences, etc.
- 58Axx General theory of differentiable manifolds**
  - A05 Differentiable manifolds, foundations
  - A07 Real-analytic and Nash manifolds [See also 32C05.]
  - A10 Differential forms
  - A12 de Rham theory [See also 14Fxx.]
  - A14 Hodge theory [See also 14C30, 14Fxx, 32Cxx.]
  - A15 Exterior differential systems (Cartan theory)
  - A17 Pfaffian systems
  - A20 Jets
  - A25 Currents
  - A30 Vector distributions (subbundles of the tangent bundles)
  - A35 Stratified sets [See also 32Bxx, 58Cxx.]
  - A40 Differential spaces
  - A99 None of the above, but in this section
- 58Bxx Infinite-dimensional manifolds**
  - B05 Homotopy and topological questions
  - B10 Differentiability questions
  - B12 Questions of holomorphy [See also 32-XX, 46G20.]
  - B15 Fredholm structures [See also 47A53.]
  - B20 Riemannian, Finsler and other geometric structures [See also 53C20, 53C60.]
  - B25 Group structures and generalizations on infinite-dimensional manifolds [See also 22E65, 58D05.]
  - B99 None of the above, but in this section
- 58Cxx Calculus on manifolds; nonlinear operators [See also 47Hxx.]**
  - C05 Real-valued functions
  - C06 Set valued and function-space valued mappings
  - C07 Continuity properties of mappings
  - C10 Holomorphic maps [See also 32-XX.]
  - C15 Implicit function theorems; global Newton methods
  - C20 Differentiation theory (Gâteaux, Fréchet, etc.) [See also 26Exx, 46Gxx.]
  - C25 Differentiable maps
  - C27 Singularities of differentiable maps [See also 14B05, 14E15, 32Bxx, 32C40, 32C45.]
  - C28 Catastrophes [See also 57R70, 58Exx.]
  - C30 Fixed point theorems [See also 47H10.]
  - C35 Integration on manifolds; measures on manifolds [See also 28Cxx.]
  - C40 Spectral theory; eigenvalue problems
  - C99 None of the above, but in this section
- 58Dxx Spaces and manifolds of mappings (including nonlinear versions of 46Exx)**
  - D05 Groups of diffeomorphisms and homeomorphisms as manifolds [See also 22E65, 57Q05.]
  - D07 Groups and semigroups of nonlinear operators [See also 17B65, 47Dxx, 47H20.]
  - D10 Spaces of imbeddings and immersions
  - D15 Manifolds of mappings [See also 54C35.]
  - D17 Manifolds of metrics (esp. Riemannian)
  - D20 Measures (Gaussian, cylindrical, etc.) on manifolds of maps [See 28Cxx.]
  - D25 Equations in function spaces; evolution equations [See also 34Gxx, 35K22, 35R15.]
  - D30 Applications (in quantum mechanics (Feynman integrals), relativity, fluid dynamics, etc.)
  - D99 None of the above, but in this section
- 58Exx Variational problems in infinite-dimensional spaces**
  - E05 Abstract critical point theory (Morse theory, Ljusternik-Schnirelman theory, etc.)
  - E07 Abstract bifurcation theory
  - E10 Applications to the theory of geodesics (problems in one independent variable)
  - E11 Critical metrics
  - E12 Applications to minimal surfaces (problems in two independent variables)
  - E15 Application to extremal problems in several variables
  - E17 Pareto optimality, etc., applications to economics
- E20 Harmonic maps
- E25 Applications to control theory (optimal and non-optimal)
- E30 Variational principles
- E35 Variational inequalities (global problems)
- E99 None of the above, but in this section
- 58Fxx Ordinary differential equations on manifolds; dynamical systems {For abstract and topological dynamics, see also 28D10, 34C35, 34C40, 54H20.}**
  - F05 Hamiltonian and Lagrangian systems
  - F06 Geometric quantization (applications of representation theory)
  - F07 Completely integrable systems (including systems with an infinite number of degrees of freedom)
  - F09 Morse-Smale systems
  - F10 Stability theory
  - F11 Ergodic theory; invariant measures [See also 28Dxx.]
  - F12 Structure of attractors (and repellers)
  - F13 Strange attractors
  - F14 Bifurcation theory and singularities
  - F15 Hyperbolic structures (expanding maps, Anosov systems, etc.)
  - F17 Geodesic flows
  - F18 Relations with foliations
  - F19 Eigenvalue and spectral problems
  - F20 Periodic points and zeta functions
  - F21 Limit cycles, etc.
  - F22 Periodic solutions
  - F25 Flows
  - F27 Quasiperiodic flows
  - F30 Perturbations
  - F35 Invariance properties
  - F40 Applications
  - F99 None of the above, but in this section
- 58Gxx Partial differential equations on manifolds; differential operators [See also 35-XX.]**
  - G05 Differential complexes [See also 35Nxx.]; elliptic complexes
  - G07 Relations with hyperfunctions
  - G10 Index theory and fixed point theorems
  - G11 Heat and other parabolic equation methods
  - G12 Exotic index theories [See also 46L05, 46L10, 46M20.]
  - G15 Pseudodifferential and Fourier integral operators on manifolds
  - G16 Hyperbolic equations
  - G17 Propagation of singularities; initial value problems
  - G20 Boundary value problems
  - G25 Spectral problems; spectral geometry; scattering theory
  - G30 Relations with special manifold structures (Riemannian, Finsler, etc.)
  - G32 Diffusion processes and stochastic analysis on manifolds
  - G35 Invariance properties
  - G40 Applications
  - G99 None of the above, but in this section
- 58Hxx Pseudogroups and general structures on manifolds**
  - H05 Pseudogroups [See also 22E65.]
  - H10 Cohomology of classifying spaces for pseudogroup structures (Spencer, Gel'fand-Fuks, etc.)
  - H15 Deformations of structures [See also 32Gxx, 58G05.]
  - H99 None of the above, but in this section
- 60-XX PROBABILITY THEORY AND STOCHASTIC PROCESSES {For additional applications, see 10Kxx, 62-XX, 90-XX, 92-XX, 93-XX, 94-XX. For numerical results, see 65U05.}**
  - 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
  - 01 Elementary exposition, textbooks
  - 02 Advanced exposition (research surveys, monographs, etc.)
  - 03 Historical (must also be assigned at least one classification number from Section 01)
  - 04 Explicit machine computation and programs (not the theory of computation or programming)
  - 06 Proceedings, conferences, etc.



**60Axx Foundations of probability theory**

- A05 Axioms; other general questions
- A10 Probabilistic measure theory {For ergodic theory, see 28Dxx and 60Fxx.}
- A99 None of the above, but in this section

**60Bxx Probability theory on algebraic and topological structures**

- B05 Probability measures on topological spaces
- B10 Convergence of probability measures
- B11 Probability theory on linear topological spaces [See also 28C20.]
- B12 Limit theorems for vector-valued random variables (infinite-dimensional case)
- B15 Probability measures on groups, Fourier transforms, factorization
- B99 None of the above, but in this section

**60C05 Combinatorial probability****60D05 Geometric probability; stochastic geometry; random sets [See also 52A22.]****60Exx Distribution theory [See also 62Exx, 62Hxx.]**

- E05 Distributions: general theory
- E07 Infinitely divisible distributions; stable distributions
- E10 Characteristic functions; other transforms
- E15 Inequalities (Čebyšev, Kolmogorov, etc.)
- E99 None of the above, but in this section

**60Fxx Limit theorems [See also 28Dxx, 60B12.]**

- F05 Central limit and other weak theorems
- F10 Large deviations
- F15 Strong theorems [See also 28A65.]
- F17 Functional limit theorems; invariance theorems
- F20 Zero-one laws
- F25  $L^p$ -limit theorems
- F99 None of the above, but in this section

**60Gxx Stochastic processes**

- G05 Foundations of stochastic processes
- G07 General theory of processes
- G10 Stationary processes
- G12 General second order processes
- G15 Gaussian processes
- G17 Sample path properties
- G20 Generalized stochastic processes
- G25 Prediction theory [See also 62M20.]
- G30 Continuity and singularity of induced measures
- G35 Applications (signal detection, filtering, etc.) [See also 62M20, 94Axx.]
- G40 Stopping times; optimal stopping problems; gambling theory [See also 62L15.]
- G42 Martingales with discrete parameter
- G44 Martingales with continuous parameter
- G46 Martingales and classical analysis
- G48 Generalizations of martingales
- G50 Sums of independent random variables
- G55 Point processes
- G57 Random measures
- G60 Random fields
- G99 None of the above, but in this section

**60Hxx Stochastic analysis [See also 58G32.]**

- H05 Stochastic integrals
- H10 Stochastic ordinary differential equations [See also 34F05.]
- H15 Stochastic partial differential equations [See also 35R60.]
- H20 Stochastic integral equations
- H25 Random operators and equations
- H99 None of the above, but in this section

**60Jxx Markov processes**

- J05 Markov processes with discrete parameter
- J10 Markov chains with discrete parameter
- J15 Random walk
- J20 Applications of discrete Markov processes (social mobility, learning theory, industrial processes, etc.)
- J25 Markov processes with continuous parameter
- J27 Markov chains with continuous parameter
- J30 Processes with independent increments

- J35 Transition functions, generators and resolvents [See also 47D05, 47D07.]

- J40 Hunt processes

- J45 Probabilistic potential theory [See also 31-XX.]

- J50 Boundary theory

- J55 Local time and additive functionals

- J57 Multiplicative functionals

- J60 Diffusion processes [See also 58G32.]

- J65 Brownian motion [See also 58G32.]

- J70 Applications of diffusion theory (population genetics, absorption problems, etc.)

- J75 Jump processes

- J80 Branching processes (Galton-Watson, birth-and-death, etc.)

- J85 Applications of branching processes [See also 60K30, 92A10, 92A15.]

- J99 None of the above, but in this section

**60Kxx Special processes**

- K05 Renewal theory

- K10 Applications (reliability, demand theory, etc.)

- K15 Markov renewal processes, semi-Markov processes

- K20 Applications of Markov renewal processes (reliability, queueing networks, etc.) [See also 90B22, 90B25.]

- K25 Queueing theory [See also 68C15, 90B22.]

- K30 Applications (congestion, allocation, storage, traffic, etc.) [See also 60J80.]

- K35 Interacting random processes, statistical mechanics type models

- K99 None of the above, but in this section

**62-XX STATISTICS {For numerical methods, see 65U05.}**

- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)

- 01 Elementary exposition, textbooks

- 02 Advanced exposition (research surveys, monographs, etc.)

- 03 Historical (must also be assigned at least one classification number from Section 01)

- 04 Explicit machine computation and programs (not the theory of computation or programming)

- 06 Proceedings, conferences, etc.

- 07 Data analysis

**62Axx Foundations**

- A05 Invariance and group considerations

- A10 The likelihood approach

- A15 The Bayesian approach

- A20 The classical approach

- A25 The structural approach

- A30 The fiducial approach

- A99 None of the above, but in this section

**62Bxx Sufficiency**

- B05 Sufficient statistics and fields

- B10 Statistical information theory

- B15 Comparison of experiments

- B20 Measure-theoretic results, etc.

- B99 None of the above, but in this section

**62Cxx Decision theory [See also 90A05; for game theory, see 90Dxx.]**

- C05 General considerations

- C07 Complete class results

- C10 Bayesian problems; characterization of Bayes procedures

- C12 Empirical decision procedures

- C15 Admissibility

- C20 Minimax procedures

- C25 Compound decision problems

- C99 None of the above, but in this section

**62D05 Sampling theory, sample surveys****62Exx Distribution theory [See also 60Exx.]**

- E10 Characterization and structure theory

- E15 Exact distribution theory

- E20 Asymptotic distribution theory

- E25 Monte Carlo studies

- E30 Formal computational methods (polykays, etc.)

- E99 None of the above, but in this section



- 62Fxx Parametric inference**  
 F03 Hypothesis testing  
 F04 Small sample properties of tests  
 F05 Asymptotic properties of tests  
 F07 Ranking and selection  
 F10 Point estimation  
 F11 Small sample properties of estimators  
 F12 Asymptotic properties of estimators  
 F15 Bayesian inference  
 F25 Tolerance and confidence regions  
 F35 Robustness and adaptive procedures  
 F99 None of the above, but in this section
- 62Gxx Nonparametric inference**  
 G05 Estimation  
 G10 Hypothesis testing  
 G15 Tolerance and confidence regions  
 G20 Asymptotic efficiency  
 G25 Quick and easy methods  
 G30 Order statistics  
 G99 None of the above, but in this section
- 62Hxx Multivariate analysis [See also 60Exx.]**  
 H05 Characterization and structure theory  
 H10 Distribution of statistics  
 H12 Estimation  
 H15 Hypothesis testing  
 H17 Contingency  
 H20 Measures of association (correlation, canonical correlation, etc.)  
 H25 Factor analysis and principal components  
 H30 Classification and discrimination; cluster analysis [See also 68Gxx.]  
 H99 None of the above, but in this section
- 62Jxx Regression and correlation**  
 J02 General nonlinear regression  
 J05 Linear regression  
 J07 Ridge regression; James-Stein estimators  
 J10 Analysis of variance and covariance  
 J15 Paired and multiple comparisons  
 J99 None of the above, but in this section
- 62Kxx Experimental design [See also 05Bxx.]**  
 K05 Optimal designs  
 K10 Block designs  
 K15 Factorial designs  
 K99 None of the above, but in this section
- 62Lxx Sequential methods**  
 L05 Sequential design  
 L10 Sequential analysis  
 L12 Sequential estimation  
 L15 Optimal stopping [See also 60G40.]  
 L20 Stochastic approximation  
 L99 None of the above, but in this section
- 62Mxx Inference from stochastic processes**  
 M02 Markov processes: hypothesis testing  
 M05 Markov processes: estimation  
 M07 Non-Markovian processes: hypothesis testing  
 M09 Non-Markovian processes: estimation  
 M10 Time series, auto-correlation, regression, etc. [See also 90A20.]  
 M15 Spectral analysis of time series  
 M20 Prediction [See also 60G25.]; filtering [See also 60G35, 93E10, 93E11.]  
 M99 None of the above, but in this section
- 62Nxx Engineering statistics**  
 N05 Reliability and life testing [See also 90B25.]  
 N10 Quality control [See also 90Bxx.]  
 N99 None of the above, but in this section
- 62Pxx Applications [See also 82-XX, 90-XX, 92-XX.]**  
 P05 Actuarial mathematics  
 P10 Biometrics  
 P15 Psychometrics  
 P20 Econometrics [See also 90Axx.]  
 P25 Sociometrics  
 P99 None of the above, but in this section
- 62Q05 Statistical tables**
- 65-XX NUMERICAL ANALYSIS**  
 -00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)  
 -01 Elementary exposition, textbooks  
 -02 Advanced exposition (research surveys, monographs, etc.)  
 -03 Historical (must also be assigned at least one classification number from Section 01)  
 -04 Explicit machine computation and programs (not the theory of computation or programming)  
 -06 Proceedings, conferences, etc.
- 65A05 Tables**
- 65Bxx Acceleration of convergence**  
 B05 Extrapolation to the limit, deferred corrections  
 B10 Summation of series  
 B15 Euler-Maclaurin formula  
 B20 Poisson formula, etc.  
 B99 None of the above, but in this section
- 65Cxx Numerical simulation {For theoretical aspects, see 68Jxx.}**  
 C05 Monte Carlo methods  
 C10 Random number generation  
 C20 Models, numerical methods  
 C99 None of the above, but in this section
- 65Dxx Numerical approximation {Primarily algorithms; for theory, see 41-XX.}**  
 D05 Interpolation  
 D07 Splines  
 D10 Smoothing, curve fitting  
 D15 Algorithms for functional approximation  
 D20 Computation of special functions, construction of tables  
 D25 Numerical differentiation  
 D30 Numerical integration  
 D32 Quadrature and cubature formulas  
 D99 None of the above, but in this section
- 65E05 Numerical methods in complex analysis (potential theory, etc.) {For numerical methods in conformal mapping, see 30C30.}**
- 65Fxx Numerical linear algebra**  
 F05 Direct methods for linear systems and matrix inversion  
 F10 Iterative methods for linear systems [See also 65N20.]  
 F15 Eigenvalues, eigenvectors  
 F20 Overdetermined systems, pseudoinverses  
 F25 Orthogonalization  
 F30 Other matrix algorithms  
 F35 Matrix norms, conditioning, scaling [See also 15A12, 15A60.]  
 F40 Determinants  
 F99 None of the above, but in this section
- 65Gxx Error analysis**  
 G05 Roundoff error  
 G10 Interval and finite arithmetic  
 G99 None of the above, but in this section
- 65Hxx Nonlinear algebraic or transcendental equations**  
 H05 Single equations  
 H10 Systems of equations  
 H15 Eigenvalues, eigenvectors  
 H99 None of the above, but in this section
- 65Jxx Numerical analysis in abstract spaces**  
 J05 General  
 J10 Equations with linear operators (do not use 65Fxx)  
 J15 Equations with nonlinear operators (do not use 65Hxx)  
 J99 None of the above, but in this section
- 65Kxx Mathematical programming, optimization and variational techniques [See also 49Dxx, 90Cxx, 93-XX.]**  
 K05 Mathematical programming  
 K10 Optimization and variational techniques  
 K99 None of the above, but in this section
- 65Lxx Ordinary differential equations**  
 L05 Initial value problems  
 L07 Stability



- L10 Boundary value problems
- L15 Eigenvalue problems
- L99 None of the above, but in this section
- 65Mxx Partial differential equations, initial value problems**
  - M05 Derivation of finite difference approximations
  - M10 Stability and convergence of difference methods
  - M15 Error bounds
  - M20 Method of lines
  - M25 Method of characteristics
  - M30 Improperly posed problems
  - M99 None of the above, but in this section
- 65Nxx Partial differential equations, boundary value problems**
  - N05 Derivation of finite difference approximations
  - N10 Convergence of difference methods
  - N15 Error bounds
  - N20 Solution of difference equations [See also 65F10.]
  - N25 Eigenvalue problems
  - N30 Finite elements, Rayleigh-Ritz and Galerkin methods, finite methods
  - N35 Collocation and related methods
  - N40 Methods of lines
  - N45 Method of contraction of the boundary
  - N99 None of the above, but in this section
- 65P05 Partial differential equations, miscellaneous problems**
- 65Q05 Difference and functional equations, recurrence relations**
- 65Rxx Integral equations, integral transforms [See also 45Lxx.]**
  - R10 Integral transforms
  - R20 Integral equations
  - R99 None of the above, but in this section
- 65S05 Graphical methods**
- 65T05 Harmonic analysis and synthesis**
- 65U05 Numerical methods in probability and statistics**
- 65V05 Automated algorithms [See also 68C05.]**
- 68-XX COMPUTER SCIENCE (including AUTOMATA) {For papers involving machine computations and programs in a specific mathematical area, see section -04 in that area.}**
  - 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
  - 01 Elementary exposition, textbooks
  - 02 Advanced exposition (research surveys, monographs, etc.)
  - 03 Historical (must also be assigned at least one classification number from Section 01)
  - 04 Explicit machine computation and programs (not the theory of computation or programming)
  - 06 Proceedings, conferences, etc.
  - 68A05 Computers and computer systems**
  - 68Bxx Software**
    - B05 General theory of programming
    - B10 Analysis of programs (schemata, semantics, correctness, etc.)
    - B15 Theory of data (filing, etc.)
    - B20 Supervisory systems, processing (serial, parallel, multi, structured, time-sharing operating systems)
    - B99 None of the above, but in this section
  - 68Cxx Metatheory (excluding automata)**
    - C01 Formal systems
    - C05 Algorithms [See also 03-XX, 65V05.]
    - C15 Queueing, scheduling [See also 60K25.]
    - C20 Symbolic computation
    - C25 Computational complexity and efficiency of algorithms
    - C30 Computable functions, unsolvability
    - C40 Turing machines, abstract processors [See also 03D10.]
    - C99 None of the above, but in this section
  - 68Dxx Automata [See also 03D05, 18B20, 68F10.]**
    - D05 General theory
    - D15 Linear automata
    - D20 Tessellation automata, iterative arrays, cellular structure
    - D25 Stochastic and nondeterministic automata
    - D27 Playing automata, learning automata [See also 90Dxx, 68Gxx.]
    - D30 Algebraic theory of automata [See also 18B20, 20M35.]
    - D35 Other types of automata
    - D37 Decomposition theory
    - D40 Reduction problems
    - D45 Realizable functions and regular events
    - D50 Experiments, state-assignments
    - D90 Transition nets
    - D99 None of the above, but in this section
  - 68Exx Discrete mathematics**
    - E05 Sorting
    - E10 Graph theory [See also 05Cxx.]
    - E99 None of the above, but in this section
  - 68Fxx Linguistics**
    - F05 Formal languages, grammars
    - F10 Automata in connection with languages [See also 03D05, 18B20, 68Dxx.]
    - F15 Stochastic models
    - F20 Semantics
    - F25 Parsing
    - F30 Translation of natural languages
    - F99 None of the above, but in this section
  - 68Gxx Artificial intelligence [See also 62H30, 68D27.]**
    - G05 Learning and adaptive systems
    - G10 Pattern recognition, speech recognition
    - G15 Theorem proving
    - G20 Problem solving
    - G99 None of the above, but in this section
  - 68H05 Information retrieval**
  - 68Jxx Simulation [See also 65Cxx.]**
    - J05 Simulation (analog, hybrid, etc.)
    - J10 Modeling
    - J99 None of the above, but in this section
  - 68K05 Miscellaneous applications of computers**
  - 70-XX MECHANICS OF PARTICLES AND SYSTEMS (must also be assigned at least one classification number from Sections 00 through 65) {For relativistic mechanics, see 83A05 and 83C10; for statistical mechanics, see 82-XX.}**
    - 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
    - 01 Elementary exposition, textbooks
    - 02 Advanced exposition (research surveys, monographs, etc.)
    - 03 Historical (must also be assigned at least one classification number from Section 01)
    - 04 Explicit machine computation and programs (not the theory of computation or programming)
    - 05 Experimental papers
    - 06 Proceedings, conferences, etc.
    - 70A05 Axiomatics, foundations**
    - 70Bxx Kinematics [See also 53A17.]**
      - B05 Kinematics of a particle
      - B10 Kinematics of a rigid body
      - B15 Mechanisms and linkages
      - B99 None of the above, but in this section
    - 70Cxx Statics**
      - C05 Forces, fields
      - C10 Potential energy
      - C99 None of the above, but in this section
    - 70Dxx Dynamics of a particle [See also 70Hxx.]**
      - D05 Newtonian dynamics
      - D10 Lagrangian dynamics
      - D99 None of the above, but in this section
    - 70Exx Dynamics of a rigid body**
      - E05 Motion of the gyroscope
      - E10 Motion of projectiles and rockets
      - E15 Motion of a general rigid body
      - E20 Perturbation methods for Euler's equations
      - E25 Poinsot method
      - E99 None of the above, but in this section



- 70Fxx Dynamics of a system of particles, including celestial mechanics**
- F05 Two-body problem
  - F07 Three-body problem
  - F10  $n$ -body problem
  - F15 Celestial mechanics
  - F20 Holonomic systems
  - F25 Nonholonomic systems
  - F30 Impulsive motion
  - F35 Collisions
  - F99 None of the above, but in this section
- 70Gxx General representations of dynamical systems [See also 58F05.]**
- G05 Riemannian geometry, tensorial methods [See also 53A45, 53A50, 53B20.]
  - G10 Generalized coordinates
  - G15 Space of events
  - G20 Impulse-energy space
  - G25 Configuration space
  - G30 State space
  - G35 Phase space
  - G99 None of the above, but in this section
- 70Hxx Hamiltonian and Lagrangian mechanics [See also 58F05.]**
- H05 Hamilton's equations
  - H10 Liouville's theorem
  - H15 Canonical transformations
  - H20 Hamilton-Jacobi equations
  - H25 Hamilton's principle
  - H30 Other variational principles
  - H35 Lagrange's equation of motion
  - H99 None of the above, but in this section
- 70Jxx Linear vibration theory**
- J05 Finite degree of freedom systems
  - J10 Normal modes of vibrations
  - J15 Conservative systems
  - J20 Nonconservative systems
  - J25 Stability of oscillatory motions
  - J99 None of the above, but in this section
- 70Kxx Nonlinear oscillations**
- K05 Phase plane analysis
  - K10 Limit cycles
  - K15 Ljapunov theorems
  - K20 Stability
  - K30 Nonlinear resonances
  - K99 None of the above, but in this section
- 70L05 Random vibrations [See also 93Exx.]**
- 70Mxx Orbital mechanics**
- M05 Satellite problems
  - M10 Orbital stability
  - M99 None of the above, but in this section
- 70N05 Exterior ballistics**
- 70P05 Variable mass, rockets**
- 73-XX MECHANICS OF SOLIDS (must also be assigned at least one classification number from Sections 00 through 65)**
- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
  - 01 Elementary exposition, textbooks
  - 02 Advanced exposition (research surveys, monographs, etc.)
  - 03 Historical (must also be assigned at least one classification number from Section 01)
  - 04 Explicit machine computation and programs (not the theory of computation or programming)
  - 05 Experimental papers
  - 06 Proceedings, conferences, etc.
- 73A05 Axiomatics, foundations**
- 73Bxx Continuum mechanics {For fluids, see 76Axx.}**
- B05 Constitutive equations
  - B10 Isotropic functionals
  - B15 Rotational groups [See also 22Exx.]
  - B20 Simple materials
  - B25 Multipolar stress theory
  - B30 Thermodynamics of solids [See also 73U05; for gases and fluids, see 80-XX.]
  - B35 Random materials
  - B99 None of the above, but in this section
- 73Cxx Elasticity {For the biharmonic equation, see 31A30, 31B30; for acoustics, see 76Q05.}**
- C05 Stress functions
  - C10 Saint-Venant's principle
  - C15 Uniqueness theorems
  - C20 Strain energy methods
  - C25 Thermal stress problems
  - C30 Anisotropic bodies
  - C35 Mixed boundary value problems [See also 45F05.]
  - C40 Nonhomogeneous bodies and inclusions
  - C45 Stress concentrations
  - C50 Nonlinear elasticity
  - C99 None of the above, but in this section
- 73Dxx Wave propagation in and vibrations of solids**
- D05 Impact and explosion problems [See also 76L05.]
  - D10 Integral transforms
  - D15 Dilatational and shear waves
  - D20 Surface waves
  - D25 Wave diffraction and dispersion
  - D30 Linear vibrations [See also 70Jxx.]
  - D35 Nonlinear vibrations [See also 70Kxx.]
  - D99 None of the above, but in this section
- 73Exx Plasticity**
- E05 Yield criteria and flow rules
  - E10 Method of successive approximations
  - E15 Slip-line theory
  - E20 Limit analysis
  - E25 Creep
  - E99 None of the above, but in this section
- 73Fxx Viscoelasticity**
- F05 Creep and relaxation functions
  - F10 Correspondence principle
  - F15 Time-dependent boundary value problems
  - F20 Aging of materials
  - F25 Environmental-dependent materials
  - F99 None of the above, but in this section
- 73Gxx Finite deformations**
- G05 Finite elasticity
  - G10 Strain energy functions
  - G15 Finite viscoelasticity
  - G20 Metal forming problems
  - G99 None of the above, but in this section
- 73Hxx Stability (linear and nonlinear)**
- H05 Buckling
  - H10 Dynamic stability
  - H99 None of the above, but in this section
- 73Jxx Aero- and hydroelasticity**
- J05 Interaction of aerodynamics and elasticity
  - J06 Interaction of hydrodynamics and elasticity
  - J10 Vibrations, flutter
  - J15 Divergence
  - J99 None of the above, but in this section
- 73Kxx Structural mechanics**
- K05 Beams, columns, rods
  - K10 Plates, discs
  - K12 Vibrations of beams, plates, etc.
  - K15 Membranes, shells
  - K20 Composite structures
  - K25 Finite element methods
  - K30 Other numerical methods
  - K35 Random excitation
  - K99 None of the above, but in this section
- 73Lxx Theory of shells**
- L05 Non-Euclidean geometry, tensorial methods [See also 53A45.]
  - L10 Anisotropic shells



- L15 Shell dynamics
- L20 Vibrations of shells
- L99 None of the above, but in this section
- 73Mxx Fractural mechanics**
  - M05 Brittle fracture, cracks
  - M10 Fatigue
  - M15 Ductile fracture
  - M20 Material instability
  - M99 None of the above, but in this section
- 73Nxx Geophysical solid mechanics [See also 86-XX.]**
  - N05 Global dynamics
  - N10 Earthquake problems
  - N99 None of the above, but in this section
- 73Pxx Biomechanics of solids**
  - P05 Mathematical models of biological materials
  - P10 Mechanics response
  - P99 None of the above, but in this section
- 73Q05 Soil mechanics**
- 73R05 Electromagnetic elasticity**
- 73Sxx Micromechanics of solids**
  - S05 Dislocation theory
  - S99 Other micromechanics
- 73T05 Contact problems**
- 73U05 Thermomechanics of solids [See also 73B30.]**
- 76-XX FLUID MECHANICS (must also be assigned at least one classification number from Sections 00 through 65) (For general continuum mechanics, see 73Bxx, or other parts of 73-XX.)**
  - 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
  - 01 Elementary exposition, textbooks
  - 02 Advanced exposition (research surveys, monographs, etc.)
  - 03 Historical (must also be assigned at least one classification number from Section 01)
  - 04 Explicit machine computation and programs (not the theory of computation or programming)
  - 05 Experimental papers
  - 06 Proceedings, conferences, etc.
- 76Axx Foundations, constitutive equations, rheology [See also 35L65.]**
  - A02 Foundations
  - A05 Non-Newtonian fluids
  - A10 Viscoelastic fluids
  - A99 None of the above, but in this section
- 76Bxx Incompressible inviscid fluids, potential theory**
  - B05 Airfoil theory
  - B10 Jets and cavities, free-streamline theory, water-entry problems, hydrofoil theory
  - B15 Water waves, gravity waves; dispersion and diffraction, nonlinear interaction
  - B20 Ship waves
  - B25 Solitary and cnoidal waves
  - B99 None of the above, but in this section
- 76Cxx Incompressible inviscid fluids, vorticity flows**
  - C05 Vorticity flows
  - C10 Internal waves
  - C15 Atmospheric waves
  - C20 Rossby waves
  - C99 None of the above, but in this section
- 76Dxx Incompressible viscous fluids**
  - D05 Navier-Stokes equations [See also 35Q10.]
  - D10 Boundary-layer theory
  - D15 Boundary-layer separation and reattachment
  - D20 Higher-order effects in boundary layers
  - D25 Wakes and jets
  - D30 Singular perturbation problems
  - D99 None of the above, but in this section
- 76Exx Hydrodynamic stability**
  - E05 Stability of parallel flows
  - E10 Inertial instability
  - E15 Convective instability
- E20 Instability of geophysical and astrophysical flows
- E25 Magnetohydrodynamic and electrohydrodynamic instabilities
- E30 Nonlinear effects
- E99 None of the above, but in this section
- 76Fxx Turbulence [See also 58F13, 58F27, 60Gxx, 60Jxx.]**
  - F05 Homogeneous isotropic turbulence
  - F10 Shear flows
  - F99 None of the above, but in this section
- 76Gxx General aerodynamics and subsonic flows**
  - G05 Hodograph methods
  - G10 Kármán-Tsien approximation
  - G15 Iterative methods
  - G20 Free-streamline theory
  - G99 None of the above, but in this section
- 76H05 Transonic flows, limit lines**
- 76Jxx Supersonic flows**
  - J05 Hodograph methods
  - J10 Method of characteristics
  - J99 None of the above, but in this section
- 76K05 Hypersonic flows**
- 76L05 Shock waves and blast waves [See also 73D05.]**
- 76M05 Nonhomentropic flows of compressible fluids**
- 76Nxx Compressible fluids and gas dynamics, general**
  - N05 Boundary layer theory
  - N10 Compressible fluids, general
  - N15 Gas dynamics, general
  - N99 None of the above, but in this section
- 76P05 Rarefied gas flows, Boltzmann equation [See also 82A05.]**
- 76Q05 Hydrodynamic sound, acoustics**
- 76Rxx Diffusion and convection [See also 60J60.]**
  - R05 Forced convection
  - R10 Free convection
  - R99 None of the above, but in this section
- 76S05 Flows in porous media; filtration; seepage**
- 76T05 Two-phase and multiphase flows**
- 76U05 Rotating fluids**
- 76V05 Multiphase and stratified fluids**
- 76W05 Magnetohydrodynamics and electrohydrodynamics**
- 76X05 Ionized gas flow in electromagnetic fields; plasmic flow**
- 76Y05 Quantum hydrodynamics and relativistic hydrodynamics [See also 83C55, 85A30.]**
- 76Zxx Biological fluid mechanics**
  - Z05 Physiological flows
  - Z10 Biopropulsion in water and in air
  - Z99 None of the above, but in this section
- 78-XX OPTICS, ELECTROMAGNETIC THEORY (must also be assigned at least one classification number from Sections 00 through 65) (For quantum optics, see 81K05.)**
  - 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
  - 01 Elementary exposition, textbooks
  - 02 Advanced exposition (research surveys, monographs, etc.)
  - 03 Historical (must also be assigned at least one classification number from Section 01)
  - 04 Explicit machine computation and programs (not the theory of computation or programming)
  - 05 Experimental papers
  - 06 Proceedings, conferences, etc.
  - A02 Foundations
  - A05 Geometric optics
  - A10 Physical optics
  - A15 Electron optics
  - A20 Space charge waves
  - A25 Electromagnetic theory, general
  - A30 Electro- and magnetostatics
  - A35 Motion of charged particles
  - A40 Waves and radiation
  - A45 Diffraction, scattering [See also 34E20 for WKB methods.]



- A50 Antennas, wave-guides
- A55 Technical applications
- A57 Mathematically heuristic optics and electromagnetic theory (must also be assigned at least one other classification number in this section)
- A99 Miscellaneous topics

**0-XX CLASSICAL THERMODYNAMICS, HEAT TRANSFER (must also be assigned at least one classification number from Sections 00 through 65) {For thermodynamics of solids, see 73B30.}**

- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
- 01 Elementary exposition, textbooks
- 02 Advanced exposition (research surveys, monographs, etc.)
- 03 Historical (must also be assigned at least one classification number from Section 01)
- 04 Explicit machine computation and programs (not the theory of computation or programming)
- 05 Experimental papers
- 06 Proceedings, conferences, etc.
- A05 Foundations
- A10 Classical thermodynamics
- A15 Thermodynamics of mixtures
- A20 Heat and mass transfer
- A25 Combustion, interior ballistics
- A30 Chemical kinetics
- A35 Mathematically heuristic classical thermodynamics (must also be assigned at least one other classification number in this section)
- A99 Miscellaneous topics

**31-XX QUANTUM MECHANICS (must also be assigned at least one classification number from Sections 00 through 65)**

- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
- 01 Elementary exposition, textbooks
- 02 Advanced exposition (research surveys, monographs, etc.)
- 03 Historical (must also be assigned at least one classification number from Section 01)
- 04 Explicit machine computation and programs (not the theory of computation or programming)
- 05 Experimental papers
- 06 Proceedings, conferences, etc.

**81Bxx Axiomatics, foundations, philosophy**

- B05 General
- B10 Logical foundations of quantum mechanics
- B99 None of the above, but in this section

**81Cxx General mathematical topics and methods in quantum mechanics**

- C05 Closed and approximate solutions to the Schrödinger, Dirac, Klein-Gordon and other quantum mechanical equations
- C10 Selfadjoint operator theory in quantum mechanics; essential selfadjointness of the Hamiltonian
- C12 Perturbation theory
- C20 Probabilistic methods in quantum mechanics
- C30 Feynman integrals and graphs; applications of algebraic topology and algebraic geometry to these problems
- C35 Path integrals
- C40 General group representations motivated by physics but not covered by Section 81Gxx below; representations of concrete classical groups such as  $SL(n, C)$ ,  $U(p, q)$ , etc. [See also 20C35, 22E70.]
- C99 None of the above, but in this section

**81Dxx General quantum mechanics**

- D05 Commutation relations
- D10 Bethe-Salpeter equation
- D15 Current algebra
- D20 Broken symmetries
- D25 Covariant wave equations
- D99 None of the above, but in this section

**81Exx Quantum field theory**

- E05 Axiomatic quantum field theory; operator algebras

- E10 Constructive quantum field theory; models of quantum fields (including Yang-Mills theories)
- E15 Renormalization theory
- E99 None of the above, but in this section

**81Fxx Scattering theories**

- F05 2-body potential scattering theory [See also 34E20 for WKB methods.]
- F10  $n$ -body potential scattering theory
- F15  $S$ -matrix theory, etc.
- F20 Particle scattering theories
- F30 Dispersion theory, dispersion relations
- F99 None of the above, but in this section

**81Gxx Particle physics (this covers all kinds of particles and interactions)**

- G05 Strong interaction
- G10 Electromagnetic interaction
- G15 Weak interaction
- G20 Applications of group theory to elementary particles
- G25 Other elementary particle theory
- G30 Applications of group theory to nuclear physics
- G35 Other nuclear physics
- G40 Applications of group theory to atomic physics
- G45 Other atomic physics
- G50 Applications of group theory to molecular physics
- G55 Other molecular physics
- G99 None of the above, but in this section

**81H05 Quantum mechanics of many-body systems**

**81J05 Superconductivity and superfluidity**

**81K05 Quantum optics**

**81L05 Quantum electrodynamics**

**81M05 Relativistic theory**

**81N05 Mathematically heuristic quantum mechanics (must also be assigned at least one other classification number in this section)**

**82-XX STATISTICAL PHYSICS, STRUCTURE OF MATTER (must also be assigned at least one classification number from Sections 00 through 65)**

- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
- 01 Elementary exposition, textbooks
- 02 Advanced exposition (research surveys, monographs, etc.)
- 03 Historical (must also be assigned at least one classification number from Section 01)
- 04 Explicit machine computation and programs (not the theory of computation or programming)
- 05 Experimental papers
- 06 Proceedings, conferences, etc.
- A05 Mathematical general statistical mechanics
- A15 Mathematical quantum statistical mechanics
- A25 Phase transitions
- A30 Statistical thermodynamics [See also 80-XX.]
- A35 Irreversible thermodynamics [See also 81H05.]
- A40 Kinetic theory of gases
- A42 Random media
- A45 Plasma
- A50 Liquids
- A55 Solids
- A60 Crystals
- A65 Metals
- A67 Lattice statistics
- A70 Transport processes [See also 85A25.]
- A75 Nuclear reactor theory
- A77 Mathematically heuristic statistical physics (must also be assigned at least one other classification number in this section)
- A99 Miscellaneous topics

**83-XX RELATIVITY (must also be assigned at least one classification number from Sections 00 through 65)**

- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
- 01 Elementary exposition, textbooks
- 02 Advanced exposition (research surveys, monographs, etc.)



- 03 Historical (must also be assigned at least one classification number from Section 01)
- 04 Explicit machine computation and programs (not the theory of computation or programming)
- 05 Experimental papers
- 06 Proceedings, conferences, etc.

**83A05 Special relativity****83B05 Observational and experimental questions****83Cxx General relativity**

- C05 Einstein's equations
- C10 Equations of motion
- C15 Closed form solutions
- C20 Classes of solutions
- C25 Approximation procedures, weak fields
- C30 Asymptotic procedures (radiation, news functions, etc.)
- C35 Gravitational waves
- C40 Groups of motions, invariance groups, observation laws, etc.
- C45 Quantization of the gravitational field
- C50 Electromagnetic fields
- C55 Hydrodynamics [See also 76Y05.]
- C99 None of the above, but in this section

**83D05 Relativistic gravitational theories other than Einstein's****83Exx Unified field theories**

- E05 Geometrodynamics
- E10 Asymmetric field theories
- E15 Five- and higher-dimensional theories
- E99 None of the above, but in this section

**83F05 Cosmology****85-XX ASTRONOMY AND ASTROPHYSICS (must also be assigned at least one classification number from Sections 00 through 65) {For celestial mechanics, see 70F15.}**

- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
- 01 Elementary exposition, textbooks
- 02 Advanced exposition (research surveys, monographs, etc.)
- 03 Historical (must also be assigned at least one classification number from Section 01)
- 04 Explicit machine computation and programs (not the theory of computation or programming)
- 05 Experimental papers
- 06 Proceedings, conferences, etc.
- A04 General
- A05 Galactic and stellar dynamics
- A10 Astronautics
- A15 Stellar structure
- A20 Stellar atmospheres
- A25 Radiative transfer
- A30 Hydrodynamic and hydromagnetic problems [See also 76Y05.]
- A35 Statistical astronomy
- A40 Cosmology (For relativistic cosmology, see 83F05.)
- A45 Radio astronomy
- A99 Miscellaneous topics

**86-XX GEOPHYSICS (must also be assigned at least one classification number from Sections 00 through 65) [See also 73Nxx, 76U05, 76V05.]**

- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
- 01 Elementary exposition, textbooks
- 02 Advanced exposition (research surveys, monographs, etc.)
- 03 Historical (must also be assigned at least one classification number from Section 01)
- 04 Explicit machine computation and programs (not the theory of computation or programming)
- 05 Experimental papers
- 06 Proceedings, conferences, etc.
- A04 General
- A05 Hydrology, hydrography, oceanography [See also 76B15, 76B20, 76B25, 76C15, 76E20, 76Q05, 76Rxx, 76U05.]

- A10 Meteorology [See also 76Bxx, 76C15, 76E20, 76N15, 76Q05, 76Rxx, 76U05, 76V05.]
- A15 Seismology [See also 73Dxx, 73Fxx, 73Mxx, 73Nxx, 73Q05.]
- A20 Potentials, prospecting [See also 76S05, 76W05.]
- A25 Geo-electricity and geomagnetism [See also 78A25.]
- A30 Geodesy, mapping problems
- A35 Atmospheric physics [See also 76C15, 76C20, 76E20, 76Rxx, 76U05, 76V05.]
- A99 Miscellaneous topics

**90-XX ECONOMICS, OPERATIONS RESEARCH, PROGRAMMING, GAMES**

- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
- 01 Elementary exposition, textbooks
- 02 Advanced exposition (research surveys, monographs, etc.)
- 03 Historical (must also be assigned at least one classification number from Section 01)
- 04 Explicit machine computation and programs (not the theory of computation or programming)
- 06 Proceedings, conferences, etc.

**90Axx Mathematical economics {For econometrics, see 62P20.}**

- A05 Decision theory [See also 62Cxx.]
- A06 Preferences
- A07 Theory of group behavior
- A08 Social choice, voting
- A10 Utility theory
- A11 Production models
- A12 Price theory
- A14 Equilibrium theory
- A15 Static economic models
- A16 Dynamic economic models
- A17 Multisectoral models
- A19 Statistical models
- A20 Economic time series analysis [See also 62M10.]
- A30 Applications to problems of human society (air pollution, etc.)
- A99 None of the above, but in this section

**90Bxx Operations research and management science**

- B05 Logistics, inventory, storage
- B10 Flows in networks, deterministic
- B15 Flows in networks, probabilistic
- B20 Highway traffic
- B22 Queueing theory, service models, etc. [See also 60K25.]
- B25 Reliability and maintenance [See also 60K20, 62N05.]
- B30 Production theory
- B35 Scheduling theory
- B40 Search theory
- B99 None of the above, but in this section

**90Cxx Mathematical programming {For papers emphasizing calculus of variations or involving abstract spaces, see 49Dxx. For numerical methods, see 65K05.}**

- C05 Linear programming
- C06 Large scale linear programming
- C08 Special problems of linear programming (transportation and multi-index problems, etc.)
- C09 Boolean programming
- C10 Integer programming
- C11 Mixed integer programming
- C15 Stochastic programming
- C20 Quadratic programming
- C25 Convex programming
- C30 Nonlinear programming
- C31 Sensitivity, parametric programming, multi-objective programming
- C32 Fractional programming
- C33 Linear and nonlinear complementarity problems
- C35 Network programming, programming in networks
- C39 Dynamic programming [See also 49Cxx.]
- C40 Markov programming



- C42 Programming in conditions of uncertainty
- C45 Markov renewal programming
- C47 Markov decision processes
- C48 Programming in abstract spaces
- C50 Applications of mathematical programming
- C99 None of the above, but in this section

**90Dxx Game theory [See also 49A45, 68D27.]**

- D05 2-person games
- D10  $n$ -person games, noncooperative
- D12  $n$ -person games, cooperative, solution concepts
- D13 Infinite games
- D15 Multistage games, stochastic [See also 93E05.]
- D20 Multistage games, recursive
- D25 Differential games
- D26 Pursuit and evasion games
- D30 Utility theory [See also 90A10.]
- D35 Decision theory [See also 62Cxx, 90A05.]
- D40 Game theory models [See also 65Cxx, 68Cxx, 68Jxx.]
- D42 Positional and lattice games
- D45 Applications of game theory
- D99 None of the above, but in this section

**92-XX BIOLOGY AND BEHAVIORAL SCIENCES**

- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
- 01 Elementary exposition, textbooks
- 02 Advanced exposition (research surveys, monographs, etc.)
- 03 Historical (must also be assigned at least one classification number from Section 01)
- 04 Explicit machine computation and programs (not the theory of computation or programming)
- 06 Proceedings, conferences, etc.
- A05 General biology [See also 73-XX, 76-XX, in particular 73Pxx, 76Zxx.]
- A07 Medical applications of biology
- A09 Physiology, biochemistry [See also 76-XX, in particular 76Z10, and 80A30.]
- A10 Genetics
- A15 Population dynamics, epidemiology
- A17 Ecology
- A20 Sociology
- A25 Psychology
- A27 Psychophysics
- A40 Chemistry [See also 80A30, 92A05, 92A09.]
- A90 Other applications

**93-XX SYSTEMS THEORY; CONTROL {For optimal control, see 49-XX.}**

- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
- 01 Elementary exposition, textbooks
- 02 Advanced exposition (research surveys, monographs, etc.)
- 03 Historical (must also be assigned at least one classification number from Section 01)
- 04 Explicit machine computation and programs (not the theory of computation or programming)
- 06 Proceedings, conferences, etc.

**93Axx General**

- A05 Axiomatic system theory
- A10 General systems
- A13 Hierarchical systems
- A15 Large scale systems
- A20 Cascaded systems
- A99 None of the above, but in this section

**93Bxx Controllability, observability, and system structure**

- B05 Controllability
- B07 Observability
- B10 Canonical structure
- B15 Realizability of systems from input-output data
- B17 Transformation
- B20 Minimal systems representations
- B25 Algebraic theory of time-invariant systems
- B30 System identification
- B35 Sensitivity

- B40 Computational methods
- B99 None of the above, but in this section

**93Cxx Control systems, guided systems**

- C05 Linear
- C10 Nonlinear
- C15 Systems governed by ordinary differential equations
- C20 Systems governed by partial differential equations
- C22 Systems governed by integral equations
- C25 Systems in abstract spaces
- C30 Systems governed by functional relations other than differential or integral equations
- C35 Multivariable systems
- C40 Adaptive
- C45 Time-invariant
- C50 Time-dependent
- C55 Discrete-time
- C57 Sampled-data
- C60 Continuous-time
- C99 None of the above, but in this section

**93Dxx Stability**

- D05 Ljapunov stability
- D10 Popov-type stability of feedback systems
- D15 Stabilization of systems by feedback
- D20 Asymptotic stability
- D25 Input-output approaches
- D99 None of the above, but in this section

**93Exx Stochastic systems and control**

- E03 Stochastic systems, general
- E05 Stochastic games, stochastic differential games
- E10 Estimation and detection
- E11 Filtering
- E12 System identification
- E14 Data smoothing
- E15 Stochastic stability
- E20 Optimal stochastic control
- E25 Computational methods
- E99 None of the above, but in this section

**94-XX INFORMATION AND COMMUNICATION, CIRCUITS**

- 00 Difficult to classify at the second level (must be assigned at least one other classification number in this section)
- 01 Elementary exposition, textbooks
- 02 Advanced exposition (research surveys, monographs, etc.)
- 03 Historical (must also be assigned at least one classification number from Section 01)
- 04 Explicit machine computation and programs (not the theory of computation or programming)
- 06 Proceedings, conferences, etc.

**94Axx Communication, information**

- A05 Communication theory [See also 60G35.]
- A11 Application of orthogonal functions in communication
- A12 Characterization of signals
- A14 Modulation and demodulation
- A15 Information theory, general [See also 62B10.]
- A17 Measures of information, entropy
- A24 Coding theorems (Shannon theory)
- A29 Source coding
- A34 Distortion theory
- A40 Channel theory
- A50 Theory of questionnaires
- A99 None of the above, but in this section

**94Bxx Algebraic theory of error-correcting codes**

- B05 Linear codes, general
- B10 Convolutional codes
- B15 Cyclic codes
- B20 Burst-correcting codes
- B25 Combinatorial codes
- B30 Majority codes
- B35 Decoding
- B40 Arithmetic codes
- B45 Prefix, length-variable, comma-free codes
- B50 Synchronization error-correcting codes



- B60 Other types of codes
- B70 Error probability
- B99 None of the above, but in this section
- 94Cxx Circuits, networks**
  - C05 Analytic circuit theory
  - C10 Switching theory, applications of Boolean algebra
- C15 Applications of graph theory [See also 05Cxx, 68D9, 68E10.]
- C30 Applications of design theory [See also 05Bxx.]
- C99 None of the above, but in this section
- 94D05 Fuzzy sets and logic (in connection with questions of Section 94) [See also 03B52, 03E72.]**



## Volume 41

#6790: Hodges, John H.

The end of the title should read "GF[ $q, x$ ]".

#6797: Suryanarayana, D.

The zero in the title should read the capital letter "O".

#8422: Serre, Jean-Pierre

The one in the title should read the lower case letter "i".

## Volume 42

#5891: Krishna, H. V.

The "A" in the title should be replaced by "a".

## Volume 43

#169: Joris, Henri

The " $\wedge$ " in the title should be replaced by " $\Omega$ ".

#6165: Korobov, N. M.

The word "symbols" in the title should be replaced by the word "digits".

#6867: Vidossich, Giovanni

The following paragraph should be added to the review:

"The results do indeed imply the indicated theorem of H. H. Corson and J. Lindenstrauss. The author shows that the function spaces are Lindelöf even in some stronger topologies, which in the separable case include the uniform topology. Thus the author has replaced the separable metric range with any  $\mathfrak{K}_0$ -space, the locally compact metric domain with a locally separable pseudometric space, and the topology with various stronger ones. The author's second theorem shows that 'locally separable' can be omitted if the topology of pointwise convergence is used".

## Volume 45

#645: Gera, Milan

On the third line of the title replace the first sign of equality by a plus sign.

#646: Gera, Milan

On the second line of the title replace the sign of equality by a plus sign.

#1534: Bedeaux, Dick

In the third line from the bottom the denotation " $(\tau_n / !)^{1/n}$ " should read " $(\tau_n / n !)^{1/n}$ ".

#2221: Sharma, B. L. [Sharma, Bhagirath Lal]

The correction to this article [MR 48 #2439] asserts that the date of receipt of this paper should read September 30, 1968. We also note the similarity of the syntax and the notation of this article and an earlier article of the author [Proc. Cambridge Philos. Sci. 64 (1968), 413-416; MR 36 #5403].

#9294: Hagopian, Charles L.

Replace the second sentence of the first paragraph by "The author cites a counterexample to show that this cannot be extended to nonlocally connected continua."

At the end of line 13, insert "A point  $r$  in  $M - \{p, q\}$  is said to cut  $p$  from  $q$  in  $M$  if each subcontinuum that contains  $\{p, q\}$  also contains  $r$ ".

In line 18 replace the word "separates" by the word "cuts".

## Volume 46

#1279: v. Westenholz, C.

In line 13 change "homology group" to "group of singular chain complexes".

In line 18 replace " $B_2$ " by " $\beta_2$ ".

In line 19 change " $\tilde{\omega} \in F^2(M)^4$ " by " $\tilde{\omega}, \tilde{\omega} \in F^2(M^4)$ , correspond to the electromagnetic field tensor".

In column two, line six replace " $H^3(M^4)$ " by " $H^3(M^4) = 0$ ".

## Volume 47

#6015: Griffin, Barry S.; Krutchkoff, Richard G.

The date of publication was incorrectly given as 1959. It should read 1969.

#6123: Koegst, Mandred; Kolp, Otto

The first author's name should read "Koegst, Manfred".

## Index for Volume 47

On page 1872 "Koegst, Mandred" should be "Koegst, Manfred".

## Volume 49

#11343: Santagati, Giuseppe

In line 14 replace "controllability" by "complete controllability".

In line 18 delete the words "arbitrarily given".

In lines 26-29 replace "Secondly . . . cost" by "Secondly, he studies the minimal cost problem for controllable problems (1), (2), (3) with weakly closed and bounded  $X, V, Y$ , where the cost".

## Volume 50

#4717: Sanerib, Richard

The reviewer wishes to delete his remarks at the end of his review.

He asserts that these remarks are entirely unsubstantiated and have no bearing on the real contents of the paper. He regrets his carelessness and hopes that it has not cast aspersions on the interesting main results of the paper.

#12999: Ferrero, M. A.

The following erratum should be added to the review:

"Over a field of characteristic 2, the quadratic form  $x_1^2 + x_2^2 + \dots + x_m^2 = (x_1 + x_2 + \dots + x_m)^2$  is degenerate for  $m > 1$ . Therefore, the objection raised by the reviewer to Lemma 1 of this paper is invalid. A corrected statement of this lemma has been published by the author [MR 53 #8106]".

## Volume 52

#2110: Kirstain, B. M. [Kirstein, B. M.]; Franken, P.; Stoijan, D. [Stoyan, D.]

The second author's name should read "Štoijan, D".

The reference "G. Pledger and F. Proschan, J. Appl. Probability 10 (1973), 572-585; MR 52 #2110" refers to the concept of the stochastic order relation for random processes and it should be written at the end of the first sentence.

#7936: Bruter, Claude P.

In line six the sentence should read "They are almost identical to an earlier publication by the author [Éléments de théorie des matroïdes, Publ. Départ. Math., Univ. Brest, 1970]".

In line nine the sentence should read, "There are several misprints and errors that will be easily recognized by the reader; the theorems and proofs remain true, however".

In line 11 the sentence should read, "These notes can serve as an introduction to those interested in the basic facts about matroids".

In the fifth line from the end, the sentence should read, "In Chapter 7 the fundamental paper by Minty could have been used to greater advantage."

In the third line from the end the sentence should read "The close connection between matroids and geometric lattices is mentioned but should have been discussed more fully, in the reviewer's opinion".

#11738: Shephard, G. C.

The following review supplements the existing review:

"This paper is a contribution to the theoretical aspects of making models of convex 3-polytopes from planar nets which are convex polygons. Although very few polytopes have a convex net, the author shows that very many combinatorial types of polytopes can be achieved including all pyramids, all prisms and all polytopes with at most six vertices or faces. He exhibits a type of polytope with 17 vertices which cannot be achieved, and gives conjectures and problems".

#12668: Mangiarotti, Luigi

Replace the review by the following:

The author studies the stationary neutron transport Boltzmann equation as applied to a three-dimensional system  $D$ , made by a rectangular multiplying core surrounded by a finite reflector, in both the Lebesgue space  $L_2(D)$  and the space  $C(D)$ .



## Volume 54

## #3025: Pallu de la Barrière, Philippe

The author's name should be "Pallu de la Barrière, Philippe".

## #3341: Ramm, A. G.

In line three replace "with a finite number of singularities" by "of finite order of singularity".

## #5018: Las Vergnas, Michel

The following is an addendum to the published review:

Hien Q. Nguyen [Proceedings of the Montana Academy of Science, vol. 37 (1977), pp. 101-102] has produced a counterexample to the author's characterization of the covering relation for  $\mathcal{L}(L)$  in terms of a condition involving the hyperplane closure  $c(B)$  of a basis. The necessity of the condition as proved by Las Vergnas is valid, but the example shows that the condition is not sufficient as not every basis will produce a covering pair of erections. Nguyen proposed that  $c(B)$  be replaced in the theorem by the set  $T$ , a minimal (for inclusion) hyperplane-closed spanning set of  $N$ .

## #6416: Gheorghe, Florin-Christian; Obreja, George

The first author's name should read "Gheorghe, Florin-Cristian".

## #7240: Kogalovskii, S. R.

The English translation "Soviet Math. Dokl. 17 (1976), no. 5, 1465-1469" should read "Soviet Math. Dokl. 18 (1977), no. 6, iv-viii.

## #11437: Mukherjee, A.; Tserpes, N. A.

In the first line replace "recurrence" by "recurrence of a point". Add the sentence "The set of recurrent points is shown to be the kernel of the semigroup".

## #13474: Gelbart, Stephen S.

The following changes are to be made:

In line 7 delete the word "then".

In line 14 replace the word "results" by "standard facts".

In the last line of (3) replace "radical" by "radial".

In lines three - four in the final paragraph delete ", including the key point (1) above".

In line 11 replace "Thon" by "Ton".

In line 14 replace "to appear" by "25 (1977), 1-49".

## Index for Volume 54

On page 2116 "Gheorghe, Florin Christian" should be "Gheorghe, Florin Cristian".

## Volume 55

## #3356: Mahajan, G. B.; Varma, R. C.

The following is an addendum to the published review:

The reviewer observes that the formulas (2.1) and (3.1) of this paper were given earlier by Lauricella (Rend. Circ. Mat. Palermo 1893, 7, 111-158). These results have been reproduced with due credits in the 1926 monograph by P. Appell and J. Kampe de Fériet (see p. 116 Eq. (10.1) & p. 117). Hence the sections 2 and 3 of this paper seem to the reviewer to be unnecessary.

## #3412: Staržinskiĭ, V. M.

The reviewer's name should read "L. Reizinš".

## #3527: Gabdulhaev, B. G.

In line three the equation should read " $(1/2 \pi) \int_0^{2\pi} x(t) dt$ ".

## #3565: Stoiński, Stanisław

In line four the equation should read, " $+ | f(x) - f(x_2) | - | f(x_1) - f(x_2) |$ ".

## #3614: Jôichi, Atsuo

The reviewer's name should be spelled, "N. Tiġa".

## #4172: Žilinskas, Antanas

In line two replace the word "multimodal" with the word "multinodal".

## #5499: Smith, Jonathan D. M.

The isomorphism on line nine of the last paragraph should read " $U/(U, U) \rightarrow M$ ".

$$\begin{array}{ccc} & \searrow & \swarrow \\ & R & \end{array}$$

## #5683b: Bergman, George

In lines 16, 18(twice) of the first paragraph and lines 19, 20 and 21 of paragraph two, replace " $k(x)$ " by " $k(\langle x \rangle)$ ".

## #5879: Fabes, E. B.; Jodeit, Max, Jr.; Lewis, Jeff E.

In line 13 of paragraph two " $L^{3/2}$ " should be replaced by " $L^{3/2}$ ".

## #5900: Matelski, J. Peter

The review should be replaced by the first three paragraphs of review 55 #8412.

## #6457: Schwartz, J. T.

The price of "Nonlinear functional analysis" should read \$28.25. We apologize to the publishers, Gordon and Breach, for our error in price and hope that the clarification of price will make this book of service to mathematicians in the field.

## #7192: Magnen, J.; Seneor, R.

The equation on line 16 should read " $\hat{h}_k \alpha(x) = [P + m(P^2 + m^2)^{-3/4} h_k](x) \chi_{\Delta \alpha}(x)$ ".

## #7530: Jameson, Anthony; O'Malley, R. E., Jr.

In line two the cost functional " $I[u, \epsilon] = 1/2 - \int_0^\infty \dots$ " should read " $I[u, \epsilon] = 1/2 \times \int_0^\infty \dots$ ".

## #8056: Lascoux, Alain

The equation on line 13 should read " $\pi_* \wedge ({}^n R \cdot \lambda)$ ".

## #8400: Adachi, Masahisa

The correct text of this review will be found in review 55 #9111.

## #8412: Abikoff, William

The first three paragraphs of this review should be replaced by review 55 #5900.

## #8670: Hsiang, Fu-cheng

In line four of paragraph three the fifth equation should read " $\Phi(t) = o\{t/p_t\}$ ".

## #8708: Love, E. R.

The equation on line two should read

$$-\pi^{-2} \int_{-\infty}^{\infty} f(g(s-x))^{-1} ds \int_{-\infty}^{\infty} g(t)(t-s)^{-1} dt = "$$

## #8729: Meisal, P.

The author's name should read "Meissl, P".

## #8902: Karlovitz, L. A.

In line five replace the word "possible" by "positive".

## #9084: Keesling, James

The final equation on line 11 of paragraph two should read " $\mathbb{I}_n(Z_n, z_n) \neq H_n(Z_n)$ ".

## #9090: Mukai, Juno

The final reference should be to "D. S. Kahn and S. B. Priddy".

## #9111: Chen, Bang Yen

The correct text of this review will be found in review 55 #8400.

## #9113: Levitt, N.

The review of the topological paper will be found under 56 #9431.

## #9174: Sjöstrand, Johannes

In line eight of paragraph four the equation should read

$$\mathcal{P} = \begin{pmatrix} P & R \\ R^+ & O \end{pmatrix}.$$

## #9272: Fedotkin, M. A.

In line four the equation " $S_+ \emptyset$ " should read, " $S_+ \neq \emptyset$ ".

## #9353: Susarla, V.; Phadia, E. G.

In line four of paragraph two, the alternative  $H_1$  should read " $F \neq F_0$ ".

## #9406: Huber, Peter J.

In line two "det S" should read "(det S)".

## #9470: Owen, D. B.; Su, Yueh-ling Hsiao

In line five the correlation " $P > O$ " should read " $\rho > O$ ".

## #9645: Zak, M. A. [Zak, M. A.]

The author's name is incorrectly spelled. It should read "Zak, M. A".



Volume 55 cont.

#10083: **Malyšev, N. G.; Dovgal', V. M.**

The reviewer's name is misspelled. It should read "A. Rapoport".

#10198: **\*Akte des II. Internationalen Leibniz-Kongresses.**

In the second line of information about the book, the last word should be spelled "Berichte".

#10199: **Biermann, Kurt-R.**

On the tenth line from the end of the review the first word should be spelled "Frobenius".

#10456: **Laksov, Dan**

In the seventh line from the end of the review the first " $(X \times X)$ " should read " $(X \times X)$ ".

#10487: **Brualdi, Richard A.**

**Peter M. Gibson** should be included with **Richard A. Brualdi** as a co-author of this paper.

#10734: **Stoll, M.**

On line six, formula (1) should read:

$$f(s) \cdot 0 = (1/c_p) \int_0 f(g \cdot w) / \mathcal{H}(w, w)^r d\lambda(W)$$

#10745 **Lewis, J. T.; Muldoon, M. E.**

In line one "k" should read "k".

In line two " $d(j_{\nu, k})^2 d_{\nu}$ " should read " $d(j_{\nu, k})^2 d_{\nu}$  increases with  $\nu$  for  $\nu$  sufficiently large, in particular  $d(j_{\nu, 1})^{2/\nu}$ ".

#10847 **Hess, Peter**

In line five the expression  $\sum_{i=1}^N b_i \partial/\partial x_i + C$ , should read " $\sum_{i=1}^N b_i \partial/\partial x_i + c$ ".

#11094 **Berezovskii, N. I. [Berezov'skiĭ, M. I.]**

In line eight of the second paragraph the lemma should read "card  $\{ \zeta: \zeta \in k_1, \phi(\zeta) - \lambda_k = 0 \} = n$ ".

#11294 **John, K.; Zizler, V.**

The mathematician's name in line four is misspelled. It should read "Toruńczyk".

#11332 **Killingbergtrø, Hans Georg; Skau, Ivar**

In line six of paragraph three the formula should read

$$S_j(x) = \sum_{m=j}^{\infty} (\sum_{k_x \dots k_j} (k_j)^{-1}) (1-y)^m.$$

#11366 **Kôno, Norio**

In line 12 the lim sup should read " $\limsup_{a \rightarrow 0}$ ".

#11488 **Zijaeva, Z. T.**

In line seven, the empirical density function " $g_{n2}$ " should read " $g_{n2}$ ".

#12243 **Ferry, L. H.; Williamson, D.**

In line six " $X_k$ " should read " $F \bar{x}_k$ ".

#12668 **Tuljaganova, M. I.**

The equation on lines five through six should read

$$S_f(y^t, y) = \sum_{Nn \leq y^t; (n, \prod_{Np \leq y} p) = 1} f(n).$$

#12809 **Finkelstein, Larry**

In lines eight, eighteen and nineteen the symbol " $\leq$ " should be replaced by " $\triangleq$ ".

#12964 **Mahajan, G. B.**

The reference to H. Srivastava and O. Daoust should be corrected to read "H. M. Srivastava" and "M. C. Daoust".

#13173 **López, Jorge M.; Ross, Kenneth A.**

The last line of paragraph one should read:  $||u|| < 16 \lambda \alpha(E)^4 \varepsilon^{-1}$ . In line 12 of paragraph two "VI" should read "V.1".

#13778 **Emelin, I. V.**

In line four the words "rate of convergence" should be replaced by the word "error".

In line five the word "worst" should be replaced by "maximal".

#13779 **Gaviano, M.**

In line 14 the equation " $(-h(z), \nabla f^0(z))$ " should read " $(-h(z), \widehat{\nabla f^0(z)})$ ".

#13857 **Kuck, David J.**

In line two the phrase "with the estimation" should be replaced by "with estimating".

In line 14 the phrase "and and algorithm" should read "and gives an algorithm".

In the final line "asynchronism" should be replaced with "asynchrony".

#13965 **Kalla, S. L.; Battig, A.**

The original review should be replaced by the following:

The author considers a problem of heat conduction in a finite circular cylinder. By making use of finite Hankel and the Laplace transforms he obtains expressions for temperature fields on one of the flat surfaces and also in the cylinder, under the boundary conditions of the first kind, in the presence of a heat source that is a function of time and position. As a particular case he also obtains the temperature distribution on one of the flat surfaces by considering the temperature on the curved surface to be zero for all times in the absence of heat source.

#13982 **Norraišas, Ē. Z.; Akišauskas, S. I.**

The second author's name is "Ališauskas, S. I".

In line six the word "basis" should read "bases" and "representation" should read "representations".

In line 13, the equation " $SU(n-1)$ " should read " $SU(n-2)$ ".

#14256 **Holland, John H.**

The reviewer's name is misspelled. It should read "Manfred Kochen."

#14443 **Christian, Choffrut**

The author's name is inverted. It should read "Choffrut, Christian."

#### Index for Volume 55

On page 9 in the entry for **Gibson, Peter M.** item 10487 should be added. On page 5 the entry for **Christian, Choffrut** should be deleted and item 14443 should be transferred to a new entry for **Choffrut, Christian**.

#### Volume 56

#37 **Rashed, Roshī**

The first word on line nine should read " $\dot{\Delta}\rho\theta\mu\eta\tau\kappa\acute{\alpha}$ ".

#113 **Schmerl, Hames H.**

In line 11, the word "cycles" should be replaced by the word "circuits".

#622 **Džrbašjan, A. M.**

In line six "the class of sequences" should read "the class of bounded sequences".

#623 **Džrbašjan, M. M.**

In line two replace "manifolds" with "spaces".

#633 **Kac, B. A.**

In line seven replace the word "three" by "the".

#652 **Nôno, Kiyoharu**

Line eight should read " $f(x_1, z_2)$  is holomorphic in the disc  $|z_2| < r_2$  and for each real number  $x_2$  with  $|x_2| < z_2$  function  $f(z_1, x_2)$  holomorphic in the disc  $|z_1| < z_1$  then ..."

#691 **Cohen, M. E.**

The equation on line 12-13 should read as follows:

$$\sum_k^{\infty} c_k (xz^s)^k / [(1+lsk)k!] = \sum_{n=0}^{\infty} z^n e^{-z} (ln+1) (ln+1)^{n-1} F_n(x) / n!, F_n(x) = \sum_{k=0}^{[n/s]} C_k(-n)_{sk}$$

$$[(-1)^s x / (ln+1)^s]^k / k!$$

The equation on lines five through seven of paragraph two should read as follows:



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$$\sum_{k=0}^{\infty} c_k d_{s k} (xz^s)^k / [(1+lsk)k!] = \sum_{n=0}^{\infty} (ln+1)^{n-1}$$

$$F_n(x) A_n(z) / n!, A_n(z) = \sum_{p=0}^{\infty} d_{n+p} (-1)^p$$

$$(ln+1)^p z^{n+p} / p!$$

The equation on line ten, paragraph two, should read as follows:

$$c_k x^k = (-1)^{sk} k! (1+lsk) [(sk)!]^{-1} \sum_{n=0}^{sk} (ln+1)^{sk-n}$$

$$(-sk)_n F_n(x) / n!,$$

# 788 Lavrent'ev, M. M.; Amirov, A. H.

In line four the equation " $f(t), (2)u \mid_{t=0} = u_0 \in [A(t)]$ ,"

should read " $f(t), (2)u \mid_{t=0} = u_0 \in \mathcal{D}[A(t)]$ ,".

# 832 Grušin, V. V.; Šananin, N. A.

In line three of the fifth paragraph " $D_+$ " should be " $D_t$ ".

# 873 Zanghirati, Luisa

On line four " $\Gamma * (P, N) \subset \mathbb{R}^n \setminus \bar{\Omega}$ " should read:

$$\Gamma * (P, N) \subset \mathbb{R}^n \setminus \bar{\Omega}.$$

# 886 Moiseev, E. I.

In line four the formula should read " $f \in W_p^{(N-1)/2}$ ,

$$p > 2N/(N-1), \sum_{k=1}^{\infty} \lambda_k^{(N-1)/2}.$$

# 922 Fabrikant, V. I.

In line 14 of the reviewer's remarks, replace the word "obtained" by "omitted".

#1229 Avérous, Geneviève; Kobayashi, Shoshichi

The equation on line 11 should read "if  $\Gamma$  acts freely on  $\hat{M}$  and  $M = \Gamma / \hat{M}$ ".

The equation on line five of paragraph two should read

$$A(\hat{M}) \text{ such that } M = \Gamma / \hat{M}.$$

# 1468 Malyšev, V. A.

On line four of the second paragraph the following parenthetical information should follow the word "parameters": "(respectively to these parameters the factorization is realized)".

# 1470 Azencott, R.; Ruget, G.

In line 14, paragraph one " $M_{\gamma(\tau)}$ " should read " $\mu_{\gamma(\tau)}$ ".

# 1566 Abou-Jaoude, Saab

In line seven of the first paragraph the equation

$$v_i = v_{i-1} + \lambda_i \text{ should read } v_i = v_{i-1} + \lambda_i^{(h)}.$$

# 2790 Deontic logic: introductory and systematic readings.

In line one of paragraph two, the first author's name should be spelled "Follesdal".

# 3503 Kel'zon, A. A.

In line one, the equation " $n \in N, (x_k^{(n)} \neq x_1^{(n)}, k=1)$ "

should read " $n \in N, (x_k^{(n)} \neq x_2^{(n)}, k \neq 2)$ ".

In line three, the parenthetical information " $(n=2,3)$ " should read " $(n=2,3, \dots)$ ".

In line ten, the sequence " $\{x_{i_n}\}$ " should read " $\{x_{i_n}\}$ ".

In line 12, the interpolation process " $L_{n=1}^-(f: x)$ " should read " $L_{n=1}^-(f: x)$ ".

# 3525 Jurahmedov, G. Ja.

The equation on line 22, " $[p_n(s) - P_n^*(s)]$ " should read:

$$[p_n(s) - P_n^*(s)].$$

# 3592 Čiragieva, S. A.

In line seven of paragraph one, " $J_{\phi, p}^{x, k}$ " should read

$$J_{\phi, p}^{R, k}.$$

# 5235 Girard, J. Y.

At the end of line 32 " $\xi(A_j B) = (\xi \cdot A_j \xi B)$ " should read

$$\xi(A_j B) = (\xi A_j \xi B).$$

# 5237 Dragalin, A. G.

In the first line of paragraph four the formula " $[x, x, A]$ " should read " $[x, w, A]$ ".

In the third line of paragraph five equation " $x, w, \bigvee_{\alpha} B$ " should read " $x, w, \bigvee_{\alpha} B$ ".

# 6100 Baimov, Š. K.

The equation in line three " $\lambda P(x')u = 0$ " should read, " $\lambda P(x')u_{\Gamma_1} = 0$ ".

# 6834 Mokljačuk, M. P.

The first sentence of the review should read "The author gives a generalization of the Jaglom method, which is well known in the Wiener-Kolmogorov theory of linear extrapolation of stationary random processes, to the case of vector-valued homogeneous random fields with rational spectrum."

In lines six through eight equations  $E_1$  to  $E_4$  should read

$$E_1 = \{(u, v) : u, v \in R, -\infty < u < \infty, v \leq t\}, E_2 = \{(u, v) : u, v \in R, -\infty < u < \infty, t - T \leq v \leq t\}, E_3 = \{(u, v) : u \in N, -\infty < u < \infty; v \in R, v \leq t\}, \text{ and } E_4 = \{(u, v) : u \in N, -\infty < u < \infty; v \in R, t - T \leq v \leq t\}.$$

# 9431 Markus, L.

The review of this control theory paper will be found under 55# 9113.







